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TWO PREHISTORIC INDIAN DWARF SKELETONS FROM MOUNDVILLE

BY

CHARLES E. SNOW

Prepared with the assistance of the Works Projects Administration

UNIVERSITY, ALABAMA

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Birmingham, Alabama

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LETTER OF TRANSMITTAL

University, Alabama
January 8, 1943

Honorable Frank M. Dixon
Governor of Alabama
Montgomery, Alabama

Sir:

I have the honor to transmit herewith the manuscript of a report entitled "Two Prehistoric Indian Dwarf Skeletons from Moundville", by Charles E. Snow. It is requested that this be printed as Museum Paper 21 of the Geological Survey of Alabama.

Respectfully,

STEWART J. LLOYD
Asst. State Geologist

332567

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TWO PREHISTORIC INDIAN DWARF SKELETONS FROM MOUNDVILLE

Charles E. Snow

ACKNOWLEDGMENTS

I am grateful to the Work Projects Administration of Alabama and the Alabama Museum of Natural History for the opportunity to make this study; for the use of the facilities and personnel employed in the preparation of this paper and for the illustrative photographs. Through the District WPA offices in Birmingham, and the Anti-Tuberculosis Clinic, facilities and supplies were provided for the X-Ray negatives made there of the bones of the dwarf skeletons. I am indebted to Mr. James T. DeJarnette, Superintendent of Mound State Monument, for a recent map of that area. Miss Constance Ashenden, Assistant Librarian of the Peabody Museum Library, and Dr. Alice Brues and Dr. Marshall T. Newman, of the Department of Anthropology, Harvard University, have kindly supplied otherwise inaccessible references. Dr. Earl W. Count of the New York Medical College has been very generous with his suggestions relative to the description and the illustration of the bones. Dr. George S. Graham, a Birmingham pathologist has examined the two skeletons and permitted publication of his diagnosis. Dr. Maury Massler, Director of the Child Research Clinic, University of Illinois, and his colleagues, Doctors A. G. Brodie, I. P. Bronstein, and H. Sicher, have examined the X-Ray plates and photographs of the bones and have graciously given permission to report their interesting diagnosis in full. Dr. C. Wesley Dupertuis, of the Presbyterian Hospital, New York City, has provided photographs and references from his unique research among midgets and dwarfs whom he measured and studied at the World's Exposition at Chicago, 1933-34. Dr. Henry A. Carey, Research Archaeologist, University Museum, University of Kentucky, has provided references on dwarfs in ancient Egypt and the Near East. Dr. Elbert B. Ruth, Anatomy Department, College of Medicine, University of Cincinnati, and Dr. Samuel Rabkin, dental pathologist, also of Cincinnati, have kindly assisted me in my study of the female dwarf skeleton in the collection at the College of Medicine. Professor Dewey G. Steele, Geneticist, University of Kentucky, has kindly furnished many references on

dwarfism found among the common domesticated animals and has critically read the manuscript. Many of his suggestions have been incorporated in it. I am also indebted to the Work Projects Administration of Kentucky for photographic and other assistance. I appreciate the interest and encouragement of Professor William S. Webb, head of the Department of Anthropology and Archaeology, University of Kentucky and I am also grateful to him for calling my attention to Fowke's description of a prehistoric Indian dwarf skeleton. Mr. Richard G. Morgan, Curator of Archaeology, Ohio State Museum, Columbus, Ohio, has kindly permitted the reproduction of the Adena pipe-figurine shown in Figure 3.

It was gratifying in the face of the war to receive permission with good wishes, from Gustav Fischer, Publisher of R. Martin's *Lehrbuch Der Anthropologie,* in Jena, Germany, and from M. P. Huard, Director of the School of Medicine of Indo-China at Hanoi, French Indo-China, to reproduce illustrations of dwarfs which have added photographically to this paper.

INTRODUCTION

The vast Indian village site, now preserved as Mound State Monument, located at Moundville, Alabama, lies in both Tuscaloosa and Hale counties in the western portion of Central Alabama. Here on the south bank of one of the great bends of the Black Warrior River, twenty-two flat topped, pyramidal earth mounds, of various heights, large and small, lie grouped over an extensive level area of approximately one-fourth of a square mile (160 acres). In nearly forty years of excavation at this site, no trade objects of either European or American colonial manufacture have ever been found associated with the thousands of Indian skeletons uncovered at Moundville. The site with its abundance of well made, shell-tempered pottery, has been placed by Cole and Deuel[1] and others in the Middle Mississippi phase, probably late prehistoric.

When C. B. Moore explored Moundville in 1904 and again in 1905[2], he gave alphabetical letters to the mounds by which they are still designated. Near Mound "G" (Figure 1) in the eastern

[1]Cole, Fay-Cooper and Deuel, Thorne, 1937, p. 216.
[2]Moore, C. B., 1905, pp. 128, 129.
——— 1907—Frontispiece.

Figure 1. United States Department of Interior map of Mound State Monument. Original map rendered to emphasize mounds. The two Indian Dwarf skeletons were found in the area marked with the double Xs northwest of Mound G. The grey areas with rounded borders indicate forest vegetation growing in small valleys which have cut their way into the flat mound area. Map courtesy of James T. DeJarnette.

section of the present park area, in April 1934, during the excavation carried on by the Alabama Museum of Natural History, the extended skeleton of a female dwarf was found buried face downward, with the arms tightly flexed, at an average depth of one and one-half feet, in the yellow clay soil, lying on top of a normal Indian skeleton. Both skeletons were unaccompanied by artifacts. Five years later, in 1939, while excavating the post-mold patterns of a group of rectangular houses located in the same general area near the same mound (Northwest of Mound "G"), the Civilian Conservation Corps, under the supervision of the National Park Service, uncovered another dwarf skeleton. It was a male who also had been buried face downward, at a depth of one foot in an extended position, with the left arm tightly flexed at the elbow; the right arm, bent at right angles, lay under the body, across the bottom of the rib-cage. The lower right leg, also bent inward at the knee joint, was placed across the back of the left knee joint. See Figure 2. The left leg was completely extended. There were no artifacts in association with the skeleton. The undisturbed, extended segments of both dwarf skeletons made possible the measurement of them including total length or stature.

The skeletons were studied at the WPA Archaeological Laboratory in Birmingham, part of the statewide project sponsored by the Alabama Museum of Natural History. After the skeletons were processed and repaired, all of the more intact bones including the vertebrae, pelves, and the crania of the dwarfs were measured and observed by the writer, with the usual instruments and techniques. See Figures 4 and 5. Additional measurements of the skulls were taken for comparison with those of an achondroplastic dwarf from Tonkin reported by Xuan Nyuen Hop.[3]

Other Indian dwarf skeletons have been found previously in the course of archaeological investigations, but unfortunately they have all become misplaced or lost, and no description other than field notes is available.

[3]Xuan-Nyuen-Hop et Nguyen-Xuan-Nguyen, 1939, pps. 177-196.

Figure 2. The Moundville male dwarf skeleton in situ, lying face downward with the lower arms and legs partially flexed. Note the short, heavy character of the limb bones. The burial was made in a house structure a post-mold of which appears as the dark disc at the end of the leg bones. Photograph 3886, courtesy of the Alabama Museum of Natural History.

Wyman[4] while working in Florida in the 1870's made the earliest record available on an Indian dwarf as follows:

> "Many fragments of an imperfect human skeleton were found in the mound on *Huntoon Island,* and near Huntoon Creek. They were covered with shells to the depth of eighteen inches, and though the place was completely explored, only the following were discovered, viz.: fragments of a skull, an imperfect lower jaw, pieces of the right and left thigh bones, a piece of an upper arm bone, some fragments of the forearm and leg, and a few joints of fingers and toes. The bones were all of a diminutive size, evidently those of a dwarf. Basing an estimate on the proportions of the thigh bones to the whole skeleton, the individual is supposed to have been about three feet and a half high. The angles and articular process of the lower jaw were broken off and the molar teeth had nearly all disappeared during life, and their alveoli had been absorbed. These facts indicate an individual which was, at the least, adult."

Likewise Gerard Fowke[5] describes the remains of a dwarf he found in one of the Ohio Adena mounds near Waverly:

> "At five and one-half feet from center with skull in the edge of a bed of ashes, which had been raked from a fire bed near the center, and the rest of the body extended on a layer of muck that formed the bottom of the mound, was a skeleton of peculiar form. It was not over five feet long but the bones were very thick and the process for attachment of the muscles were extraordinary in their development. The skull was nearly half an inch thick and of unusual size mostly back of the ears though the forehead was full and high. The teeth were large, hard and but little worn."

It is clear that Fowke described the skeleton remains of a dwarf, probably an achondroplastic, buried in an Adena Mound. It is also interesting to note that an eight inch, clay, tubular pipe-figurine was found in the original Adena Mound,[6] Ohio, which suggests in its realistic treatment, the typical achondroplastic dwarf body-build. See Figure 3. It perhaps indicates that such dwarfs were familiar to the modeler of the well made pipe-figurine.

Another dwarf skeleton was excavated at Belle Glade, Florida,[7] and like the others, has been lost.

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[4]Wyman, Jeffries, 1875, p. 62.
[5]Fowke, Gerard, p. 372.
[6]Mills, William C., 1907, pp. 28, 29, 30.
[7]Stewart, T. Dale, 1940.

Fig. 3. Side and front views of the clay, tubular pipe-figurine from the Adena Mound, Ohio. The mouthpiece is at the top and makes up part of the headdress. Although but eight inches in length, it portrays well the typical achondroplastic proportions. Note the very short, muscular legs and the location of the elbows well above the waist line. In normal adults, the elbows extend nearly to the hip bones. Courtesy of the Ohio State Museum.

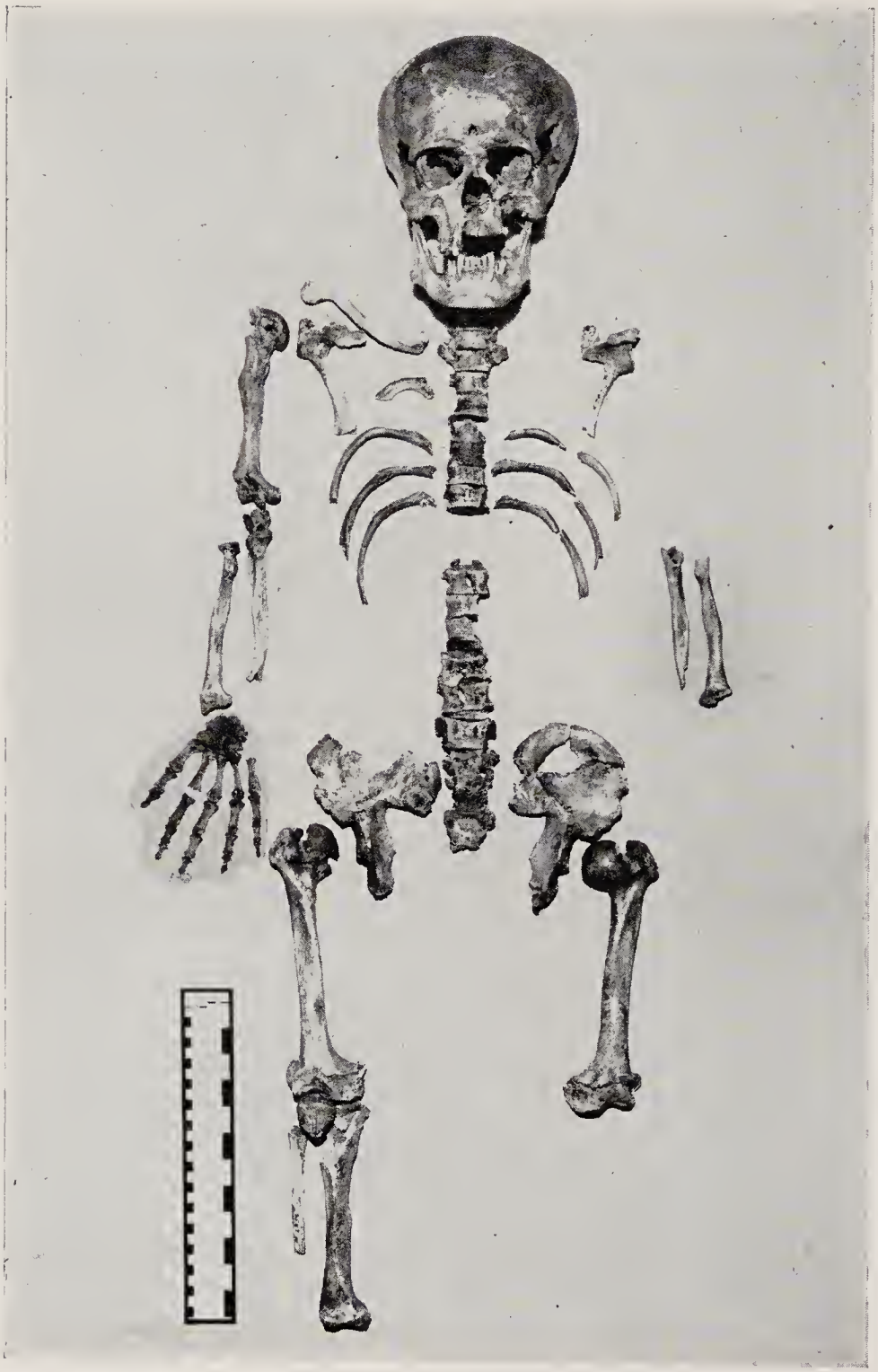

Figure 4. The assembled male dwarf skeleton from Moundville arranged in approximate anatomical position. The scale is in centimeters and inches.

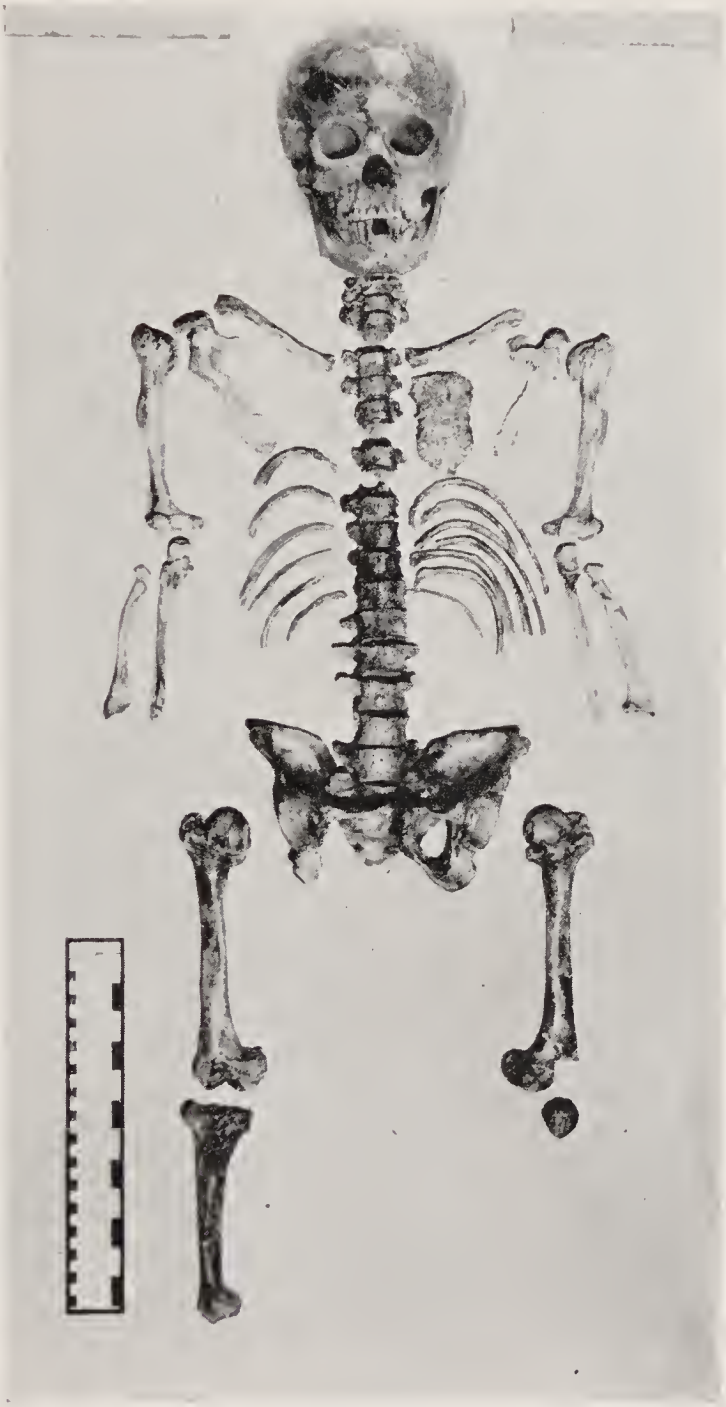

Figure 5. The assembled female dwarf skeleton from Moundville arranged to approximate the probable stature of 49 inches as measured by the field archaeologist. The skull has been partially restored. The scale is the same as in Figure 3.

MORPHOLOGICAL OBSERVATIONS

Morphologically, the bulging, overlarge, and rounded cranial vault is the most noticeable feature of the male dwarf skull. See Figures 6-10. The skull form, flattened in back by the pronounced occipital deformation leaves the parietal and frontal regions unusually prominent. The suture patterns are all submedium in serration. All of the bones of the vault are unusually thick. The very high frontal region is characterized by great breadth and height, slight slope, prominent bosses, large continuous browridges, medium development of the glabellar eminence, a medium nasion depression, and large post-orbital constrictions. The parietals are very large in size with prominent bosses, large foramina and medium fullness along the temporal borders. The flattened occipital region is broad and has little curvature. The position of the occipital bone is low at the point of articulation with the parietals at Lambda. The nuchal area is fairly rugged with the superior lines curving inward to terminate in a prominent, conical-shaped external protuberance. See Figure 10. The basion region is very low and flat, flanked by medium-sized, broad, flat condyles which lie only slightly below the plane of the poria (Porionic plane). The temporal glenoid fossae are deep, with medium to large posterior processes. The tympanic plates are of medium thickness, the auditory meati are oval in shape and have several small exostoses near the borders. The mastoid processes are very large, and the petrous portions are slightly depressed. The great wings of the sphenoid bone as they articulate with the rounded sides of the parietals show a medium degree of depression. The orbits are large, oval in shape, with the larger curves to the outside, and have a medium to large amount of slant. The malar bones are large with medium anterior and lateral projections. The suborbital fossae are deep with pronounced lateral notches, both created possibly by extensive alveolar abscesses. The nasal root is low and medium in breadth; however, the lower portions of the nasal bones are broken. The nasal sills are dull, the spine of medium size. The amount of alveolar prognathism is pronounced, but the total facial protrusion is slight. (Total Facial Angle 87°). This, along with the depressed nasal root, gives the general facial profile a concavity, typical of this type of dwarf (Dish-faced). The lower jaw is large and robust, with a prominent medio-bilateral chin form; the alveolar prognathism is slight. The genial tubercles are small, the my-

Figure 6. The male dwarf skull from the left side. Note the concavity of the facial region and the prominent forehead. The back of the skull is flattened by cradle-board deformation during infancy. Many teeth were abscessed and lost during life, others show decay (caries). About 3/5 natural size.

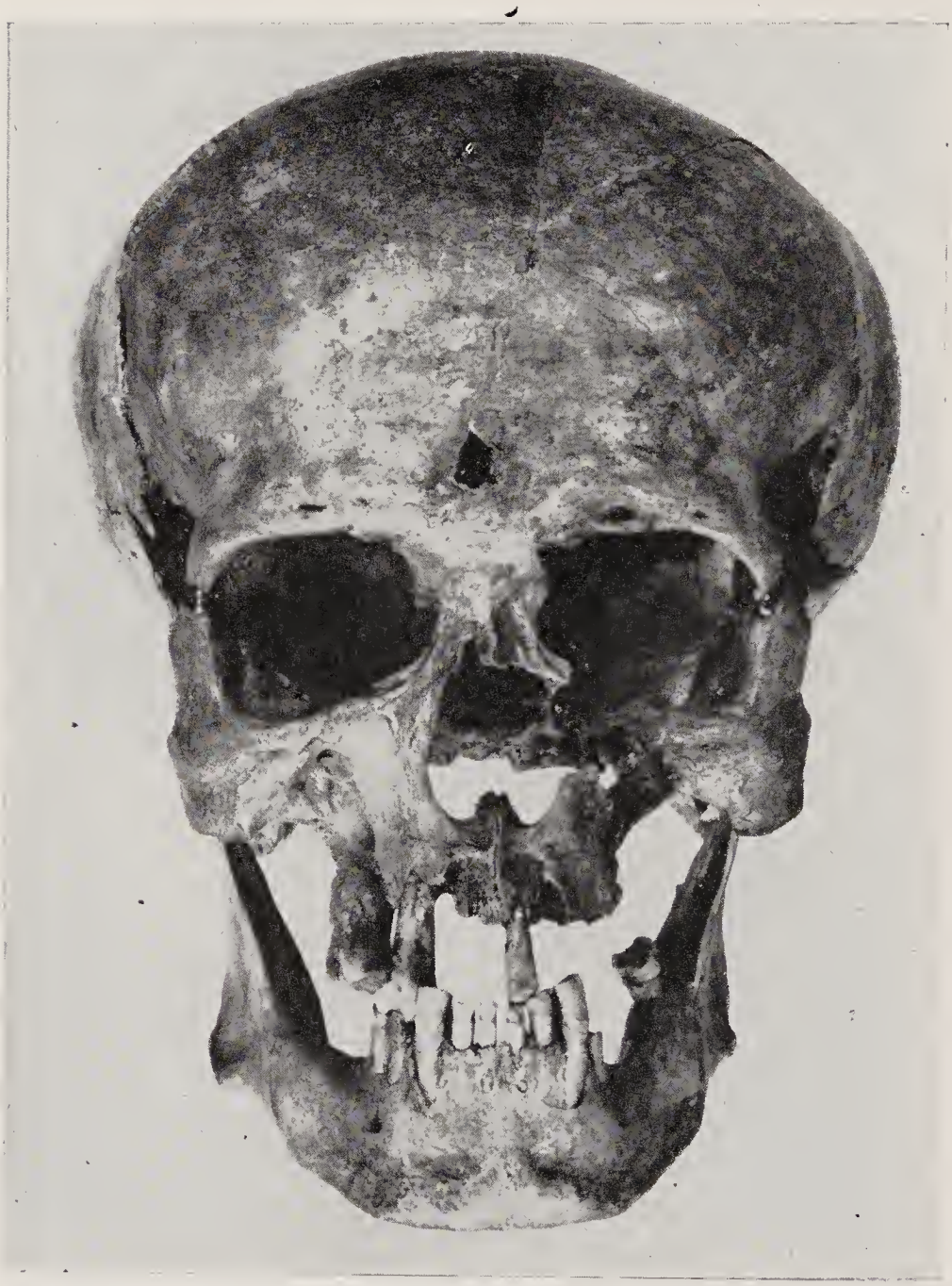

Figure 7. Front view of the male dwarf skull. Note the bulging sides of the large vault and the flare of the lower jaw. About 3/5 natural size.

lohyoid ridges well marked and the gonial region rugged and strongly everted. Both alveoli bear evidence of extensive abscesses and subsequent absorption of the root sockets of lost teeth. The few remaining teeth, many decayed by numerous large caries, suggest an edge-to-edge or slight-over type of bite. The upper left central incisor tooth shows pronounced wear, less than half of the crown height remains.

Figure 8. Back view of the male dwarf skull. Again note the bulging sides of the vault and the flat basal region. About 3/5 natural size.

Figure 9. Top view of the male dwarf skull (face down). Note the flattened back of the skull produced by cradleboard binding during infancy. About 3/5 natural size.

Figure 10. The male dwarf skull in the base view. The small foramen magnum and flat condyles are characteristic. The projection at the top is the external occipital protuberance. Several of the decayed teeth can be seen. About 3/5 natural size.

The morphology of the skull of the Moundville female dwarf is typical although unfortunately the posterior portions of the vault are missing. See Figures 11-14. The frontal and facial regions are smaller duplicates of the corresponding parts of the male dwarf skull. From the side, the prominent bulging frontal region gives way to a low concave facial contour. The jaws project to a pronounced degree and meet in a slight overbite. The chin eminence is receding but rather well developed.

The bones of the vault are very thick but well formed with the sides full and well rounded. The curves of the parietal bones suggest that the skull may have been deformed by occipital flattening. The sagittal suture meets the coronal at bregma far to the left and is simple in serration. The squamous portions of the temporal bones are curiously concave and contact the parietals low on the sides of the vault. The mastoid processes are medium sized and rounded; the supramastoid crests mediumly developed.

The face is medium in size with fairly deep suborbital fossae, medium-sized malars which are not markedly prominent. The nasal sills are sharp and the alveolar prognathism pronounced. The gonial flare of the lower jaw is slight. The upper incisors are shoveled and show slight to medium wear while the six upper molar teeth lacking occlusal contact with the lower molars (lost through abscesses) exhibit slight wear. Dental caries are present in two teeth; abscesses in six.

The skull base is small in size and is depressed with probably little relief. The foramen magnum though incomplete is very small and is flanked by small condyles of little elevation or curvature.

These morphological features are presented for comparison with those of the male dwarf from Moundville, the Tonkin male dwarf from French Indo-china, and the female dwarf from Cincinnati, Ohio, in Comparative Table I.

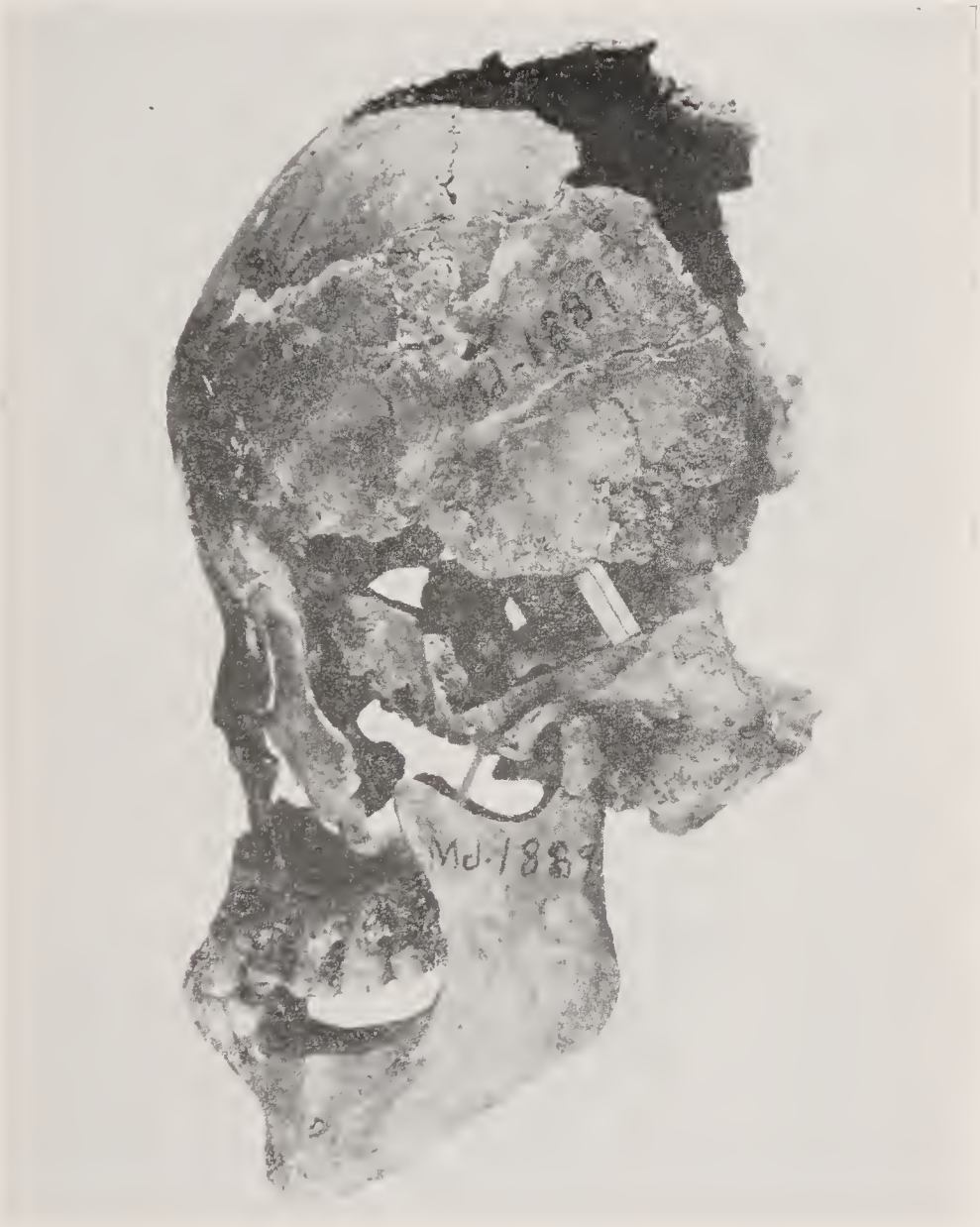

Figure 11. Side view of the female dwarf skull. Like the male, the facial profile is concave. Note the bulging forehead and the protrusion of the tooth-bearing parts of the jaws. The lower back teeth were lost during life by abscesses. About 3/5 natural size.

Figure 12. Front view of the skull of the female dwarf. Although not as extreme as in the male, the brain case is abnormally large. About 3/5 natural size.

Figure 13. Top view of the female dwarf skull. About 3/5 natural size.

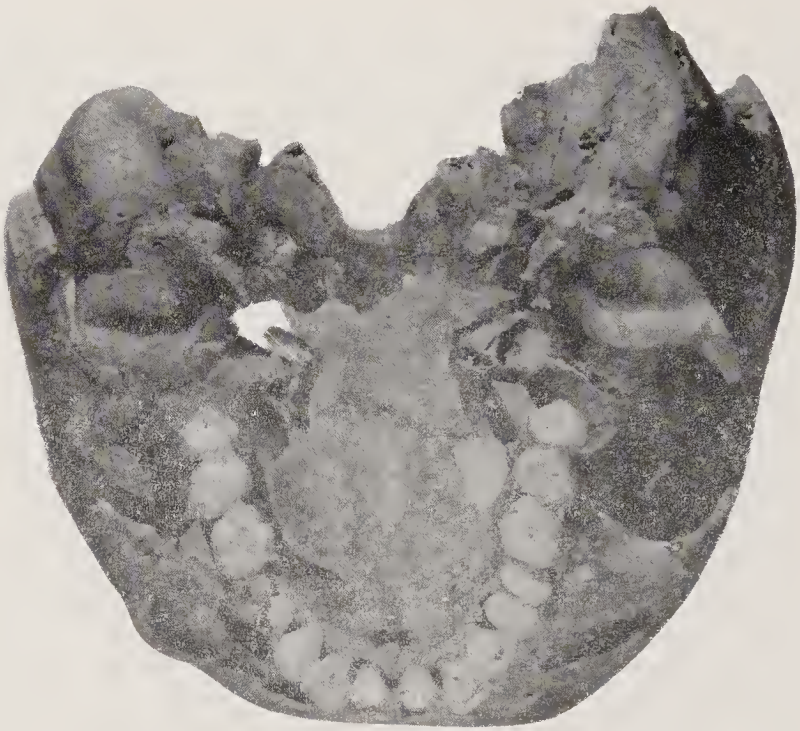

Figure 14. Bottom view of the female dwarf skull. Note the shovel incisors, a common Mongoloid feature. About 3/5 natural size

CRANIAL MEASUREMENTS AND INDICES

In Table II, measurements of the male dwarf skull are placed beside those of the deformed series from Moundville. The effects of this peculiar pathological condition upon the bony structure of the head can, perhaps, be understood by comparing the measurements of the dwarf with those of his normal associates from the same site. Immediately, many interesting differences stand out especially in the vault diameters of maximum breadth, auricular height, minimum frontal breadth, bi-orbital breadth, nasion-menton height, and the circumference and arcs. The maximum breadth actually exceeds the length. Presumably, most of the measured vault diameters are affected by the pronounced degree of the vertical occipital deformation, but nevertheless, the excessive gross size differences between the measurements of this normal series and the dwarf are perhaps best seen in the very high calculated cranial capacity of 2011 cc. which is equaled only by the contents of two other aboriginal crania.[8] So expanded are the sides of the vault that the auditory meati are pushed laterally and downward to the extent that the auricular height nearly equals the basion-bregma height. This expansion of the sides of the skull might suggest that the rounded-out, enlarged vault has invaginated the skull base. It is clear that the cranial vault has been abnormally distended probably by the same pathology which halted so drastically the development of the extremities.

The indices involving interrelationship of various cranial parts (proportions) of the dwarf male reflect the differences noted above. The alteration of the head form by the intentional artificial deformation, in addition to the abnormally distended vault, is illustrated by the high cranial index (103.4) (the breadth exceeds the length) compared with the average (93.8) of the normal deformed crania from the site. The cranial module and the low cranio-facial indices indicate again the abnormally large size of the dwarf cranium. When the breadth is compared with the height (breadth-height) the magnitude of the breadth is demonstrated by the low ratio obtained. The relationship of the forehead breadth to maximum breadth of the vault, even with the large size of the first named, falls below the normal range. The addi-

[8]Hrdlicka. Ales. 1939, pp. 62. 64.

tion to this vault expansion and the great length of the face, shows up in the high value of the total facial index.

Like the more complete male dwarf skull but to a lesser extent, the female dwarf skull when compared with the normal deformed series from Moundville, is much larger, broader and lower; differences which show up in the indices formed between the vault dimensions. The face is narrow and in its proportions distinctly different from the other Moundville females.

POST-CRANIAL SKELETON

Likewise, the long bones of the dwarfs are compared with those of the normal Indians from the same site and archaeological background. All of the limb bones show particular reduction of length with unusually well developed shafts and well marked areas of muscular origins and insertions. This unusual relationship of extreme shortness coupled with such robust shaft development, yields an index of robustness which is very high compared with normally proportioned limb bones. (Middle circumference divided by maximum length).

The limb bones of the two Moundville dwarfs, regardless of the sex differences, are characterized by the same morphology. Furthermore, it is possible and advisable to describe the bones of both together since they are so similar. The extreme contrasts between the limb bones of the dwarf skeletons and those of the normal and averaged-sized Indian are clearly evident from all measurements. See Comparative Tables III and IV. The impression one gains from an inspection of the dwarf bones is that the shafts have been telescoped, leaving normal sized, robust extremities. Heavy short bones are the principal morphological characteristics. Each bone is described below and is illustrated in Figures 15-28, one half natural size.

HUMERUS

The humeri of both dwarfs present extremely short lengths which are for the male, 60 per cent; female, 55 per cent, of the average-sized, normal bones of Moundville aborigines. This shortness of the shaft leaves the appearance of unusual development and robustness. The long bones show hypertrophies at sites of muscu-

lar attachment doubtlessly caused by functional activities which they were ill-equipped to perform.

The heads of the humeri extend forward and medially with lipping of the lower margins of the articular surfaces leaving them mushroomed. The tubercles are very prominent and extend superiorly to constitute the maximum extension (length) of the proximal extremity. The intertubercular grooves are broad, but shallow, bordered by rugged lateral cristae which form the insertions of the large pectoral muscles. The crest which marks the radial groove, one of the most outstanding bony developments, is so hypertrophied in the male bones as to form an extra tubercle not unlike the lesser trochanter of a femur. See Figures 15, 16, and 17.

The shafts are bowed into a general antero-posterior concavity, especially marked in the distal halves, throwing the olecranon region abnormally forward. The cross section of the shafts at the middle are triangular, with the base medio-anterior.

The trochlear surfaces of the female bones are malformed with obliteration of the anterior coronoid and radial fossae. The coronoid fossa of the right male humerus is small but deep. Posteriorly, the olecranon fossae of both dwarfs are slit-like and extend deeply upward and anteriorly, particularly in the male, less so in the female. These fossae are sharply conical in shape. See Figure 28c. The trochlear surfaces of the female humeri are divided, below, by deep fissures. The articular surfaces of the trochleae and capitula are compressed from above downward, and become narrower, posteriorly and show lipping on the edges.

The prominent medial epicondyles are unusually large and well defined. The areas of the origins of the long radial-carpal muscles are deep sulci with rough lateral borders. The conformations of the trochlear surfaces, along with the shallow sigmoid notches of the ulnae prevent the usual extension of the elbow joints, a characteristic condition cited by Morch.[9] The torsion present in the dwarf humeri appears normal and is approximately 45 degrees in each.

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[9]Morch, E. T., 1940, p. 439.

ULNA

The dwarf ulnae are approximately 63 per cent as long as the averaged sized normal Moundville Indian's. Again, the shafts are unduly heavy compared with the diminuitive lengths.

The upper extremities of the dwarf ulnae are characterized by very wide and shallow sigmoid notches. In both dwarfs, the origins of the supinator muscles arise from deep irregular fossae, bound in the female by a large crest. In the male, and to a lesser degree in the female, the insertion areas of the brachialis lie in rugged shallow pits. The shafts are well developed with the usual and normal triangular cross section and appear to show the usual amount of bowing.

Only the distal extremities of the female ulnae are present and these are very rugged with an enlargement of the styloid processes which leave them as large as the articular heads themselves, and are separated by rough, deeply-excavated grooves. See Figures 15, 16, and 17.

RADIUS

The radii of the dwarfs are approximately 65 per cent as long as those of the average Moundville Indian. (Male, right, 72%; Female, right—57%, left—60%). The dwarf bones are very rugged with well developed crests and tubercles.

The head of the male radius is shallow and very large; whereas, the heads of the female bones are nearly conical in shape and are definitely abnormal. The shafts show a medium amount of lateral bowing and are prismatic in cross-section. The distal radial extremities of both dwarfs are well developed with large and shallow articular surfaces. See Figures 15, 16, and 17.

Figure 15. The right arm bones of the male dwarf. Note the short, heavy character of the bones with their large areas of muscular attachment. The left half shows the anterior views of the humerus, ulna and radius. On the right: posterior views of the redius and humerus, with the ulna in lateral view between them. One half natural size.

Figure 16. The right arm bones of the female dwarf. On the left; the anterior views of the humerus, ulna and radius. On the right; the posterior view of the radius, the lateral view of the ulna and the posterior view of the humerus. One half natural size.

Figure 17. The left arm bones of the female dwarf. On the left: the anterior views of the humerus, ulna and the radius. On the right: the posterior view of the radius, the lateral view of the ulna and the posterior view of the humerus. Note the cleft in the lower articular surface seen in the last view. One half natural size.

Figure 18. Top: The right arm and collar bones of both Moundville dwarfs placed with those of an average-sized Indian male. The male dwarf bones are on the left; the female to the right. The collar bones are not as short relatively as are the other long bones. The female dwarf clavicle is above; the male dwarf below. Bottom: The leg bones of the male and female dwarfs compared with the right femur of an average-sized male Indian. The male left femur and right tibia are on the left; the right leg bones of the female dwarf on the right. The scale is the same for both sets of bones in centimeters and inches.

CLAVICLE

The clavicles of both dwarfs are 87 per cent as long as those of the normal Moundville Indian's and in general shape and curvature, appear normal. The shafts of the male clavicles are very stout and the sternal extremities of the bones of both dwarfs show well developed areas of origin for the large pectoral muscles The small size differences between these bones and normal ones should be noted. See Figures 18 and 19.

THE THORAX

Unfortunately, the fragmentary condition of most of the ribs of both dwarfs, prevented an adequate description of the ribs. However, the fragments in general appear to be of normal size and general dimensions.

The sternum of the female dwarf is well preserved and presents a fusion of the sterno-manubrial joint. This breast bone is unusually short, extremely broad and sharply bent backward from the line of fusion. This bone, bearing seven closely spaced costal notches, probably indicates that at least the anterior portion of the female thoracic cavity was very short. See Figure 19.

Figure 19. A. The back view of the patellae (knee-caps) of the dwarfs; top female, bottom male. B. The front view of the breast bone of the female dwarf. Note the short board character. C. Side views of the same patellae showing lipping of the edges of the articular surfaces. D. The sternum of the demale dwarf seen from the right side. E. The right clavicles of the dwarfs; Top, the female, lower, the male. F. Top view of the atlas of the male dwarf. The skull rests on the two kidney-shaped surfaces of the bone, the uppermost of the neck vertebrae. One of these surfaces is numbered 2856. One half natural size.

VERTEBRAL COLUMN

A description of the vertebral column will be limited to that of the female dwarf since all of her bones present are intact. Most of the male vertebrae are very fragmentary.

All the female vertebrae are present except five cervical and three thoracic. When the articulated column is arranged leaving spaces for the missing members, the length thus approximated, approaches very closely that of a normal, average-sized female Indian. See Figure 20A. Vertebrae of both dwarfs show periosteal lipping of the bodies, particularly in the cervical and to a lesser extent in the thoracic regions. In the female, the cervical and lumbar vertebrae show considerable lipping which is probably some form of arthritis. (Spondylitis deformans?).

SACRUM

The sacrum of the male dwarf is in fragments, and the larger part of the median anterior surface indicates medium curvature.

The diminutive but otherwise normal appearing female sacrum is approximately 77% as large as the normal Moundville Indian female. The miniature sacrum has the usual five segments and a medium curvature which begins at the third segment. The superior surface is homobasal with faint indications of the simian notches; the spinal closure on the posterior surface begins at the level of the fourth segment. See Figure 21.

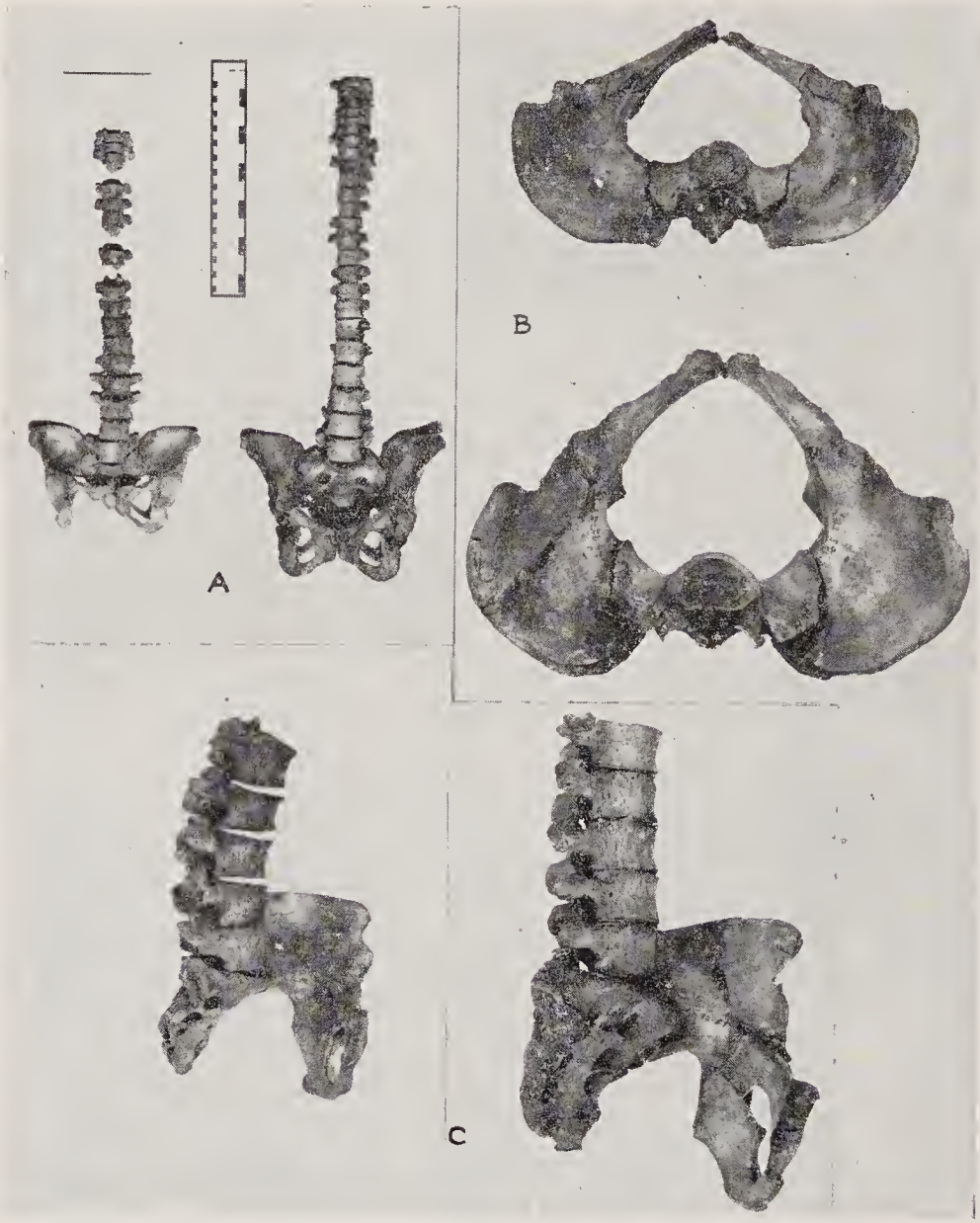

Figure 20. A. The articulated vertebral column and pelvis of the female dwarf placed on the same plane (the sacral promontories) with that of a normal Indian female. The spaces in the dwarf spine indicate the missing vertebrae: three thoracic and five cervical. Note that the two spinal columns are nearly the same length. B. Top views of the articulated pelves to the same scale of the female dwarf above and the normal female Indian below. C. Views of the articulated lumbar vertebrae, sacra and left hip bones of the female dwarf on the left and the normal Indian female on the right. Note the backward tilt of the dwarf sacrum which usually gives the achondroplastic dwarf the lordosis curve and prominence of the buttocks. Both views are to the same scale.

Figure 21. Front and left side views of the sacrum of the female dwarf. One half natural size.

PELVIS

The fragmentary hip bones of the male dwarf may be disposed of by noting the characteristically narrow (male) greater sciatic notches and the well developed muscular areas and the robust character of the ilia. The left hip bone appears to have pathological tissue on the external surface. See Figure 22.

The female pelvis is nearly complete, lacking only the inferior ramus of the right pubis. Taken as a whole, the pelvis is 88% as large as the average of the normal female Moundville Indian. See Figure 20B. It presents a curious morphology with its flattened, heart-shaped brim and diminutive size which would probably have precluded the possibilities of successful childbearing. The anterior iliac spines are well developed and prominent. The subpubic arch and the greater sciatic notches are wide and considered with the large obturator foramina, indicate femaleness. See Figures 20 and 23. The public symphysis, if unaffected by the general growth disturbance suggests an age of 35-40 years (Phase VII). Like the male bones, the areas of muscular origins are well

marked. The center portions of the ilia are perforated by small oval holes in the regions of greatest thinning. See Figure 20B.

When the right hip bone is removed (from the female pelvis) and the left pelvic half with the articulated sacrum is viewed from the median sagittal plane (See Figure 20C) the pronounced tilt of the sacrum can be noted. This acute angulation beginning at the level of the sacro-iliac joint, in addition to the fat-laden and heavy tissues of the buttocks, probably threw the posterior into very prominent relief and characterized the little Indian dwarf with a typical lordosis curve.

Figure 22. Medial and lateral views of the left innominate bone of the male dwarf (hip bone). The spongy nature of the lateral side is pathological. One half natural size.

Figure 23. Medial and lateral views of the left innominate bone of the female dwarf. One half natural size.

FEMUR

The dwarf femora are short, with heavy, well developed shafts and are little more than half as long as those from the average-sized normal Indian from Moundville. (Male—59%, Female—56%).

The upper extremities of the femora of both dwarfs are characterized by large femoral heads which are mushroomed along the inferior borders forming lateral, anterior extensions over the femoral necks. The femoral necks are very short, thick, and lie with a very sharp angulation, nearly 90 degrees to the axis of the shaft. See Figures 24 through 27. The foveal depressions are large in all four and are particularly deep in the female bones. The intertrochanteric crests are well developed, forming superiorly the great trochanters which extend medially into a well rounded border overhanging large deep trochanteric fossae, the insertion areas of the external obturator muscles. The trochanters are large in all four specimens; the lesser trochanters extend medially as sharply defined finger-like processes.

The shafts of all four femora are characterized by slightly concave shafts in the sagittal plane. In cross-section, the shafts are triangular with the larger base in front. Posteriorly, the femoral liniae asperae are developed into medium sized pilasters, especially in the female. The gluteal tuberosities are very large, long and rough in all four. See Figures 24 through 27. The torsions of the shafts appear to be normal, with the greater in the case of the female bones. The left male femur shows a twist of approximately 25 degrees; the right female femur, 40 degrees.

The lower extremities of the femora are large and wide and in the case of the female, the condyles are separated behind by very narrow, straight-sided intercondyloid fossae. See Figure 28D. In these bones, the lateral condyle of the right is very small, with a long narrow articular surface. The medial condyle is nearly twice the size of the lateral one. In the right femur of the female, there are exostoses and lipped borders present on both condyles.

Figure 24. The leg bones of the male dwarf. From left to right: the medial surface of the right femur, the anterior surface of the left femur, and the anterior surface of the right tibia (shin bone). One half natural size.

Figure 25. The leg bones of the male dwarf. From left to right: the lateral surface of the right femur, the posterior surface of the left femur, and the medial surface of the right tibia showing spongy bone pathology. One half natural size.

Figure 26. The leg bones of the female dwarf . From left to right: anterior surface of the right femur, the medial surface of the left femur and the anterior view of the right tibia. One half natural size.

Figure 27. The leg bones of the female dwarf. From left to right: the posterior surface of the right femur, the lateral surface of the left femur, and the medial surface of the right tibia. Note the retroversion of the tibial head. One half natural size.

TIBIA

The tibiae of the dwarfs, both rights, are short and very stout with pronounced muscular markings and well defined shin crests. It is an interesting coincidence that only the right tibia was preserved in both skeletons. Compared with the normal sized Moundville Indian tibiae, the dwarf bones are both 57 per cent as long.

The upper extremities of the right tibiae present pronounced posterior retroversion and backward overhang. The lateral condyle is missing on the male tibia, but the condyles of the female are complete though edged with lipping. The tuberosity of the female tibia is prominent and rough over most of its surface.

The shafts of both tibiae are very thick and large compared with the lengths and at the middle are triangular in cross-section (Hrdlicka's Type II) with the larger base medial. The tibia of the female shows pronounced antero-posterior bowing; the male, somewhat less. The interosseous crest is particularly well marked. There is some form of pathology characterized by patches of irregularly swollen spongy tissue with small perforations of the surface, possibly periostitis or ostitis.

The lower extremities of both tibiae are large and extend medially to form strong, prominent processes. The medial malleolus of the female is missing. The inferior articular facet of the male bone is large, flat and smooth, and normal in relationship to the axis of the shaft. In the female tibia, however, the plane of the joint surface is bent downward and inward, so that the foot would be turned sharply inward. See Figures 26 and 28A.

Figure 28. A. The right tibia of the female dwarf with needles attached through the centers of the articular surfaces to show the planes. Note the sharp angulation of the lower joint surface at the ankle which would result in the foot being turned inward. This probably caused the female dwarf to walk bowlegged. Anterior view. B. The left femoral head of the female dwarf showing the very short neck and unusual form. Anterior view. C. The lower end of the left humerus of the female dwarf presenting an unusual cleft in the articular surface. Posterior view. D. The condyles of the right femur of the female dwarf showing the narrow intercondylar fossa and the exotoses of the larger medial condyle. Views B, C and D slightly reduced.

FIBULA

The shaft fragments of the fibulae of both dwarfs are marked by prominent muscular borders and the surfaces and the shaft cross-sections are in keeping with the ruggedness of the other bones of the lower extremities.

STATURE

It is likely that the field measurements taken on the undisturbed and extended body segments of both dwarf skeletons are close approximations. The following measurements were recorded at the time the skeletons were excavated:

MALE DWARF

	Metric	English
Total length	148.8 cm.	53.0 in.
Top of skull to left knee	123.2	48.5
Top of skull to pelvis	67.8	26.5
Skull base to pelvis	50.8	20.0
Shoulder breadth	40.6	16.0

FEMALE DWARF

Total length	124.5 cm.	49 in.
Skull, vertebrae and sacrum	78.7	31
Length of vertebrae	55.9	22
Length of vertebrae plus sacrum	61.0	24
Hips to heel	45.7	18

Figure 2 shows the male dwarf skeleton *in situ*.

The field measurements do not, however, make provision for the thickness of the skin and underlying tissues of the bottoms of the feet, of the scalp, etc.

It is interesting to note that where the stature is known, as in the cases of the Tonkin and Lyon Museum dwarfs, the Pearson

formulae give results which run two cm. (about 1 inch) smaller than the observed stature. The formulae are of course devised for and applicable to normal leg bones of Whites and it is obvious that their use in cases which involve pathology is very questionable. It is apparent that the abnormally short leg bones of the Moundville dwarfs do not yield reliable results in spite of the fact that in relation, one to the other, (tibio-femoral index) they approach the leg proportions of the normal series from Moundville. It is the long, nearly normal torso which offsets the formulae applied to the leg bones. For what they are worth, the calculated statures for the male is 127.0 cm. (50 inches); for the female, 117.9 cm. (46½ inches.)

HAND AND FOOT BONES

Although noticeably smaller in size compared with normal hand and foot bones, the dwarf specimens are not as proportionally undersized as the long bones. The right wrist and hand bones of the male dwarf are well preserved. The foot bones of the female dwarf are fairly well preserved, and like the male hand bones, show no unusual features other than their smaller size.

DIAGNOSES

Dr. George S. Graham, who first examined the bones of the dwarfs, reports the result of his examination as follows:*

> "In the case of the dwarfs, there are, of course, several possibilities to be considered in explanation, but I agree with your conclusion that the deformities have resulted from an epiphyseal disturbance. Rickets can certainly be ruled out. The skeletal bones are well developed except as to length and the man may well have been a Samson in miniature. There is, as you know, some deformity of the upper ends of the humerus and femur such as might have resulted from defective epiphyseal bone formation. The epiphyseal margins have long disappeared, thur arguing against cretinism, where also we would expect a more slender skeletal type. A form of true dwarfism is described that is unassociated with demonstrable pathological changes but here we should not expect the disproportionate shortening and thickening of the limb bones. After all is said, the conformation of the skeletal bones in the present cases points very definitely toward an epiphyseal disturbance, especially when considered with the fact that the membranous bone of the skull is well developed while the basal region shows typical disturbances.

*Diagnosis enclosed in personal communication, 1940.

In the matter of terminology, ... , I personally would prefer the term "chondrodystrophy" as indicating a failure of normal bone formation from the epiphyseal cartilage. The individuals would then be called chondrodystrophic dwarfs."

Dr. Maury Massler and his colleagues, after examining the X-Ray negatives and photographs of the bones of the dwarf skeletons, have been able to draw the following conclusions:

1. "Condition—Dwarfism

2. Age—Middle Age (As judged by the dentition)

3. The cartilage-covered proximal articular heads of the femur and the humerus are flattened, undercut and mushroomed. The distal condyles of the femurs are bent sharply backwards. The significance of these findings is not clear.

4. All the long bones are markedly shortened in length, indicating a decided arrest in endochondral bone formation at the epiphyseal plates. The fingers exhibit this to a lesser degree than the other bones. These findings are usual in Achondroplasia. The skull offered the greatest amount of information.

5. The size of the male skull is entirely too large when compared with the rest of the skeleton. However, this is in harmony with the fact that *post-natal* endochondral bone formation in the skull exists at only three sites (the spheno-occipital junction, the nasal area, and the condylar heads of the rami).

6. The anterior cranial base (sella to nasion) is normal in length. The spheno-frontal and spheno-ethmoidal suture-complex is the essential site of post-natal growth in this dimension and is non-cartilaginous.

7. The posterior-cranial base (sella to basion) appears foreshortened. The spheno-occipital junction is the essential site of post-natal growth in this dimension and is cartilaginous, (endochondral) similar to epiphyseal growth.

8. Cranial vault. Thick inner and outer tables indicate normal if not exuberant endomembranous bone formation.

9. Occipital flattening with parietal bossing. This is often a result of decreased growth of the posterior cranial base but the pos-

sibility of a cranial *type* or mechanical factors operating during infancy should be considered.*

10. Sinuses. Frontal and maxillary sinuses large and well developed. This eliminates the possibility of pituitary or thyroid dwarfism.

11. The large supraorbital ridges and the mastoid processes indicate maleness.

12. The cartilaginous portion of the nasal area shows a distinct under-development and folding inward. As a result, the brow and chin are prominent and give to the face a "dish-faced" appearance. This is the usual facies in Achondroplasia.

13. Jaws. Tendency to Class 111 relation (mandibular prognathism due to maxillary under-development) typical of "dish-faced" individuals. The condylar heads grow by endochondral bone formation. It is surprising that a greater deficiency in ramus height did not occur.

14. The vertebrae appear normal in length, giving the impression of a long-bodied individual with extremely short extremities and unusually large head, and with a "dished" face—the description of a typical achondroplastic dwarf.

CONCLUSIONS:

1. All sites of cartilaginous growth markedly affected.

2. Endomembraneous bone formation not markedly affected.

3. Data listed above rules out dwarfism due to pituitary, thyroid or nutritional deficiences.

4. The relation between the size of the skull and the rest of the skeleton, and the characteristics of the cranio-facial listed above suggest Achondroplastic Dwarfism."[10]

IMPRESSION: Postnatal chondrodystrophia; probably achondroplasia.

These pathologists agree in general that these skeletons are the pathological results of a condition known as chondrodystrophia or achondroplasia. The X-Rays are reproduced in Figures 29 through 31.

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*Brachycranial type deformed occipitally.

[10]Massler, Maury, Dr., Personal communication, June 27, 1941.

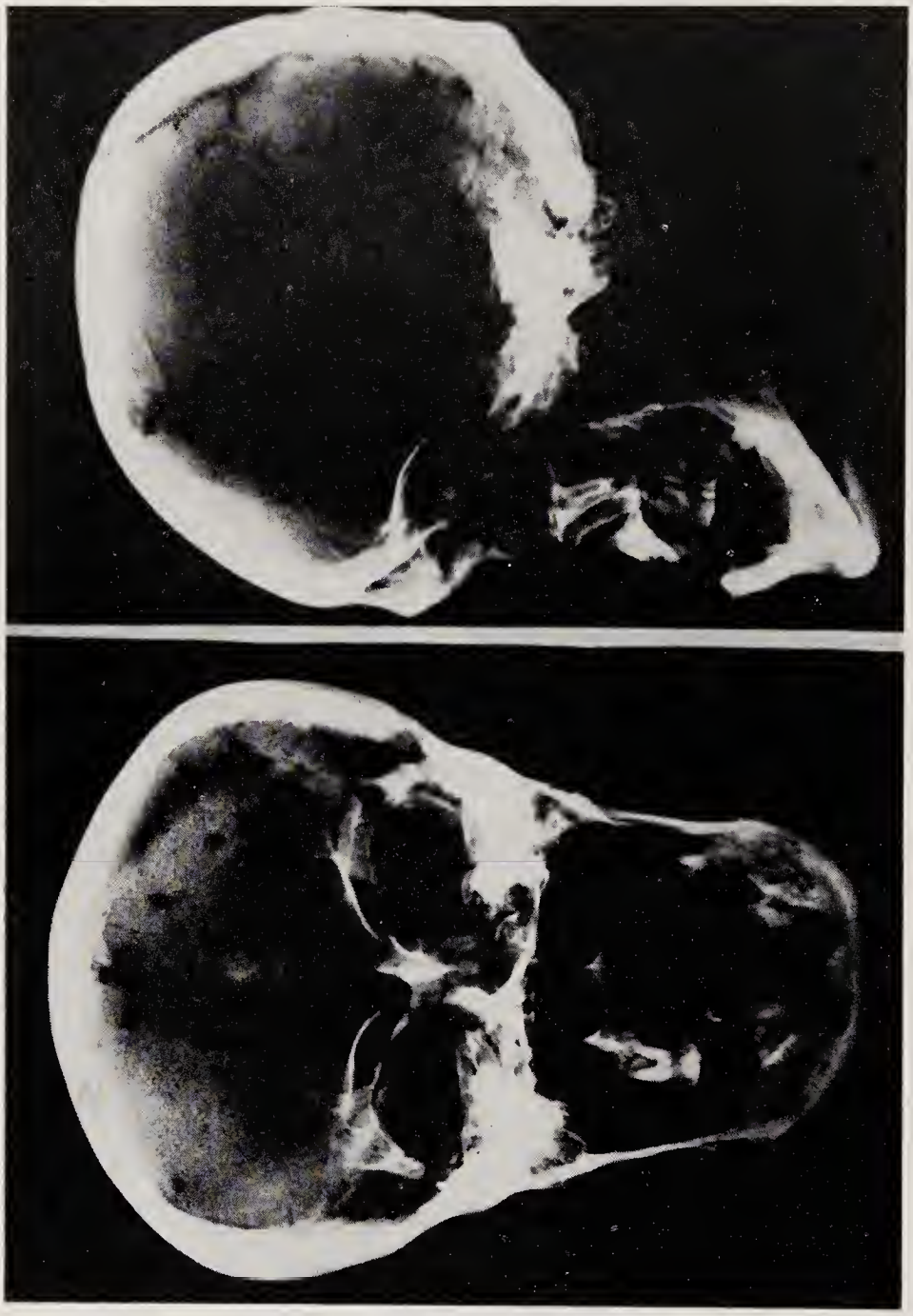

Figure 29. Photograph of the front and side view X-Rays of the Moundville male dwarf skull.

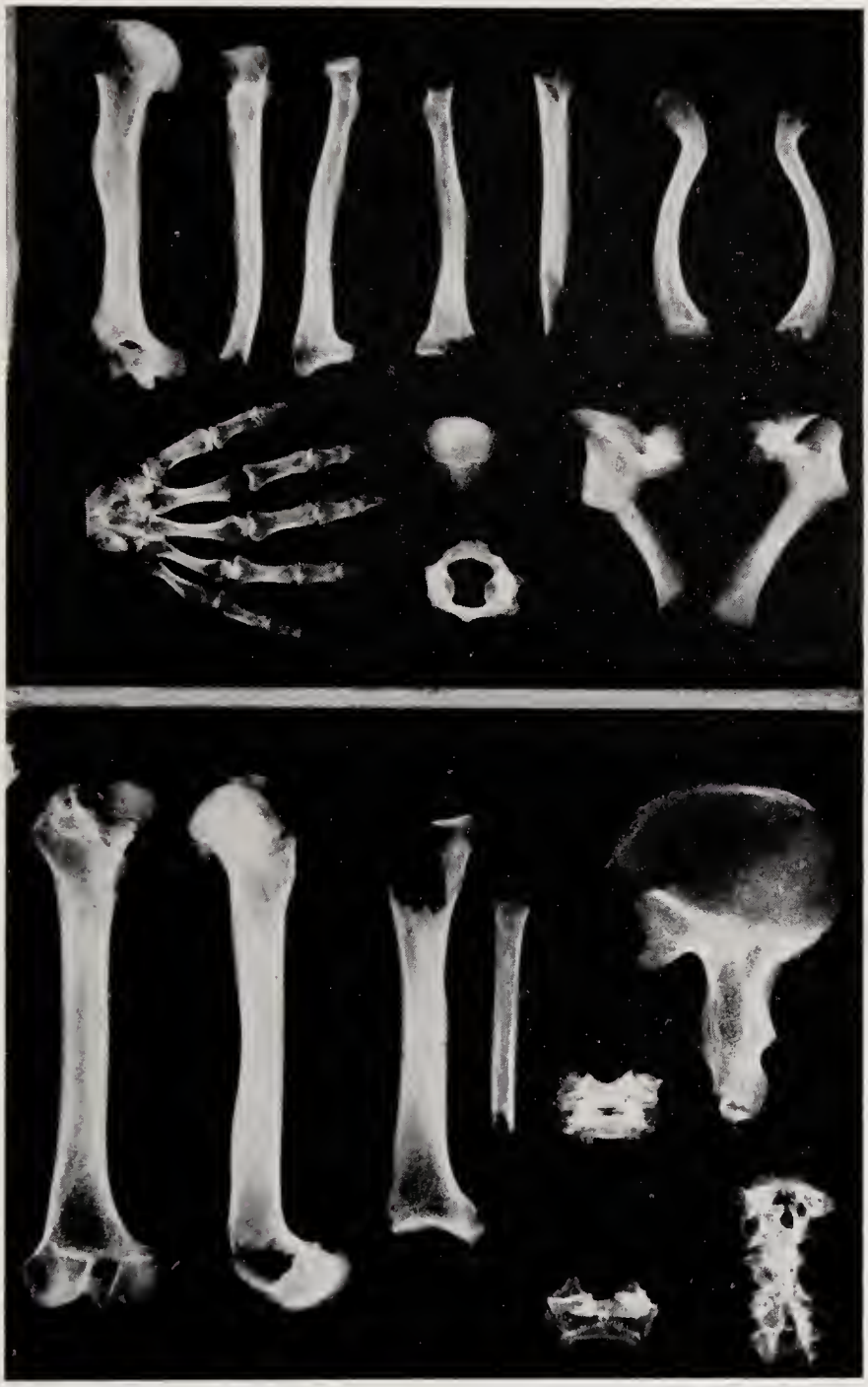

Figure 30. Photograph of the X-Ray Plates of the bones of the Moundville male dwarf

Figure 31. Photograph of the X-Ray plates of the bones of the Moundville female dwarf including the skull vault fragments at lower left of the top view.

ETIOLOGY

Before we discuss the etiology of this form of dwarfism, achondroplasia, it might be well to give a good description of it. In his splendid monograph on dwarfism, Rischbieth[11] describes achondroplasia as follows:

"Dwarf growth, the result of insufficient development and premature ossification and union of epiphyses with diaphyses (Chondrodystrophia hypoplastica" Kaufman; "Achondroplasia", Parrot). The individuals of this class have short arms and legs, relative to the size of the trunk, which is of approximately normal growth. This shortness of extremities is indicated by the term "micromelia" (little limbs).

The features of this condition are:

1. Smallness of stature

2. A normal trunk

3. A large head

4. Excessive muscular development. Arms are muscular and held a little abducted from the trunk as a result of the disproportionate size of the head of the humerus.

5. Arms short. When fingers are fully extended their tips do not reach beyond the great trochanters of the femora or even the crests of the ilia, whereas in the normal individual they reach as far as the middle third of the thigh.

6. Lower limbs short and massive. They show angular deformation, more or less marked, just above and below the knees. These occur at the site of union of epiphysis pubis. (In the normal individual the upper border of the symphysis pubis is about midway between the vertex and the soles of the feet.) In these individuals the length of the trunk, measured from the episternal notch to symphysis, is of about normal length for age, and the proportions to each other of the measurements between the vertex and symphysis and episternal notch and symphysis are normal.

8. The above shortening of limbs is of the "Rhizomatic" as opposed to the "mesomelic" type, the proximal segment being more

[11]Rischbieth, H., 1912, p. 386.

shortened than the middle segment.

9. The hands and feet are short, thick and broad, the fingers of equal length; the same condition is shown in the feet.

10. The digits of the hands diverge at their extremities in extension, showing the "main en trident" and as in the infant. The metacarpal bones and phalanges are shortened, but this shortening is relatively less than that of the bones of the other two segments of the limb (thigh and leg; arm and forearm).

"The head, proportionately, is larger than normal, and in some cases the increase is absolute. In shape it is rounded or brachycephalic. The frontal and parietal eminences are prominent. The face is relatively small but with large features. The bridge of the nose is broad and flat. The nose is retrousse, the nostrils are large. The shape of the head as a whole presents some rough resemblance to an inverted pear. The teeth are normal. The palatine vault, though sometimes of the high arched or Gothic type, is usually regularly formed and of the normal shape. The thorax is normally formed, but the lower border is often prominent. The scapulae are of defective development, but are proportionately less deficient than the humeri, because, in the former, chondral ossification commenced later in life than in the latter. The spine shows no abnormal curvature. But the normal lumbar curve is increased, or is made to appear so, by the excessive development of the buttocks. The general muscular development is great. Their weight accords well with their body size and is above that of children of the same height.

"The genital organs are normal. The female may become pregnant and this fact makes the pelvic deformity of great importance. Achondroplastiacs differ greatly from cretins and most other dwarfs in their mental qualities. They are of average intelligence but often show minor peculiarities in their mental attributes."

Many theories have been advanced to explain this condition. It seems probable that it is hereditary although other factors may be involved. An interesting case in point is a Filipino family described by Capinin,[12] in which the condition appeared in three generations. He states that the "dwarfing tendency . . . seems to behave as a Mendelian dorminant, not necessarily sex-linked, but probably autosomal." Morch[13] also considers it a dominant

[12]Capinin, Jose M., Nov., 1937, pp. 361-362.

[13]Morch, E. T., Oct. 1940, pp. 439-444.

character.

Laudauer[14] has made a very comprehensive study of a similar chondrodystrophic condition in the Creeper fowl. The trait is inherited as a Mendelian dominant and is lethal when homozygous. Embryos homozygous for this gene usually die in the third or fourth day of incubation although a few have lived as late as the last week of incubation. He also points out that similar types of dwarfism (affecting the head and extremities) occur also in fowl apparently as the result of nutritional disturbances or deficiencies. He cites Morquio's and Kashin-Beck's diseases of uncertain etiology as specific inhibitors of post-natal growth. According to Martin,[15] dwarfism is not confined to any one racial stock but has appeared sporadically at all times among humankind.

Recessive achondroplasia in calves has been discussed by Graydon W. Brandt.[16] It seems obvious that heredity is involved in these cases.

Malfunction of the thyroid and pituitary glands has been suspected of causing achondroplasia, but if this should be the case, it is possible that the malfunction itself may be hereditarily produced.

HISTORICAL BACKGROUND

Dwarfs have been depicted by artists from the earliest times. The earliest representations come from Egypt. The Egyptian God, Bes,[17] is apparently an achondroplastic dwarf. The statue of Khnemhotep[18], carved from limestone, shows also the typical achondroplastic proportions and features including the short fingers.

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[14]Landauer, Walter, 1940, pp. 172-175.

[15]Martin, R., 1928, Vol. 1, p. 249.

[16]Brandt, Graydon W., June, 1941, p. 183-186.

[17]Erman, Adolf, p. 76 and Newberry, Perry E., 1894, p. 428.

[18]Maspero, G., 1921, p. 82, Figure 150.
Schaefer and Andrall, 1925, p. 231. Also Figure 83, Curtius, L., B.D. 1, p. 27, Burgers *Handbuch der Kunstwissenshaft*, from Martin, R., *Lehrbuck der Anthropologie,* Vol. 1, 1928, p. 249.

Seneb,[19] carved at Gizah in the period of the 6th Dynasty, and shown with his normal wife and apparently normal offspring, was another achondroplastic dwarf.

Figures of dwarfs in relief have been found in the cylinder seals excavated from early sites in the Near East.[20]

Descriptions that seem to indicate achondroplasia can be found throughout history. The famous fabler, Aesop,[21] and Atila,[22] the "Scourge of God", appear from descriptions to have been achondroplastic dwarfs. Only well-known dwarfs have left a mark on history, but the fate and relative frequency of dwarfs is pure conjecture.

COMPARATIVE DATA

Happily, there are descriptions available of other achondroplastic dwarfs and a comparison of them is in order. One interesting observation is that regardless of racial antecedents, achondroplasia produces remarkably similar morphology. The Tonkin (Indo-China) skeleton of Mongoloid antecedents is undoubtedly the most closely related skeleton available for comparison with the Indian dwarfs. This is fortunate because it has been described more completely than any other.

The skeleton of this Tonkin male, age 38, is 113.0 cm. (44.5 inches) tall. It is very typical, with enlarged skull, normal trunk, short, heavy upper and lower extremities. See Figure 32. It is very similar to the Moundville male even including the shovel-shaped upper incisor teeth.

The achondroplastic dwarf skeleton from the Lyon Museum, Lyon, France, is a female of 54 years, presumably white, 106.5 cm. (42.0 inches) tall. See Figure 32. Although the head and face do not show an exaggerated malformation, the torso and extremi-

[19]Scharff, Alexander, 1941, Plate X op. page 48, Fig. 4.

[20]Frankfort, H., 1939, pp. 78, 150, 173, 179, 221, 224.

[21]Encyclopedia Britannica, Vol. 1, 11th ed. 1910, p. 276.

[22]Encyclopedia Britannica, Vol. 2, 11th Ed. 1910, pp. 885, 886.

ties are typical. The pelvis is described as "infantile" with the sacrum forming nearly a right angle with the lumbar column immediately above.

The female skeleton at the University of Cincinnati, College of Medicine, Cincinnati, Ohio, was recovered from dissection room material years ago and data regarding it are unavailable. The age is estimated at 21-25 years, the height is approximately 111.6-114.2 cm. (44-45 inches). With the exception of the missing right arm bones and mandible, the skeleton is in good condition and exhibits the typical morphology, including the incomplete extension of the left lower arm at the elbow.

Comparative Tables V and VI list for comparison the measurements and indices of four dwarf skeletons, including the two Moundville specimens.

The correspondence between the skeleton and the living form of typical achondroplastic dwarfs of both sexes is portrayed in Figure 32. In greater detail, the side and front views of the typical achondroplastic dwarf skull, placed for comparison with the soft part morphology of the head of a living dwarf, is presented in Figure 34.

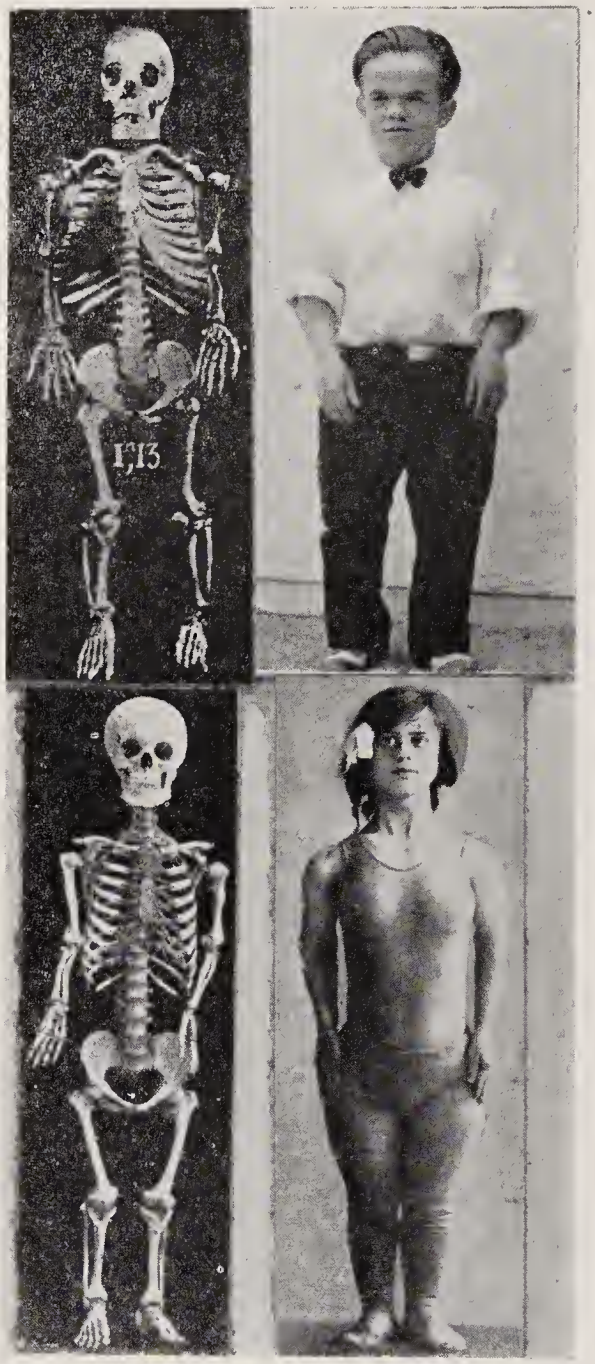

Figure 32. Male and female achondroplastic dwarfs. Upper left: Tonkin Male skeleton. Upper right: White American Male, 33 years old, 118.8 cm, 46.5 inches tall; weight 86 pounds. Lower left: French female from the Lyon Museum. Lower right, German female. All views arbitrarily reduced to the same size. Photographs of the Tonkin and German dwarfs reproduced with permission from the publishers. The American Courtesy of C. W. Dupertuis.

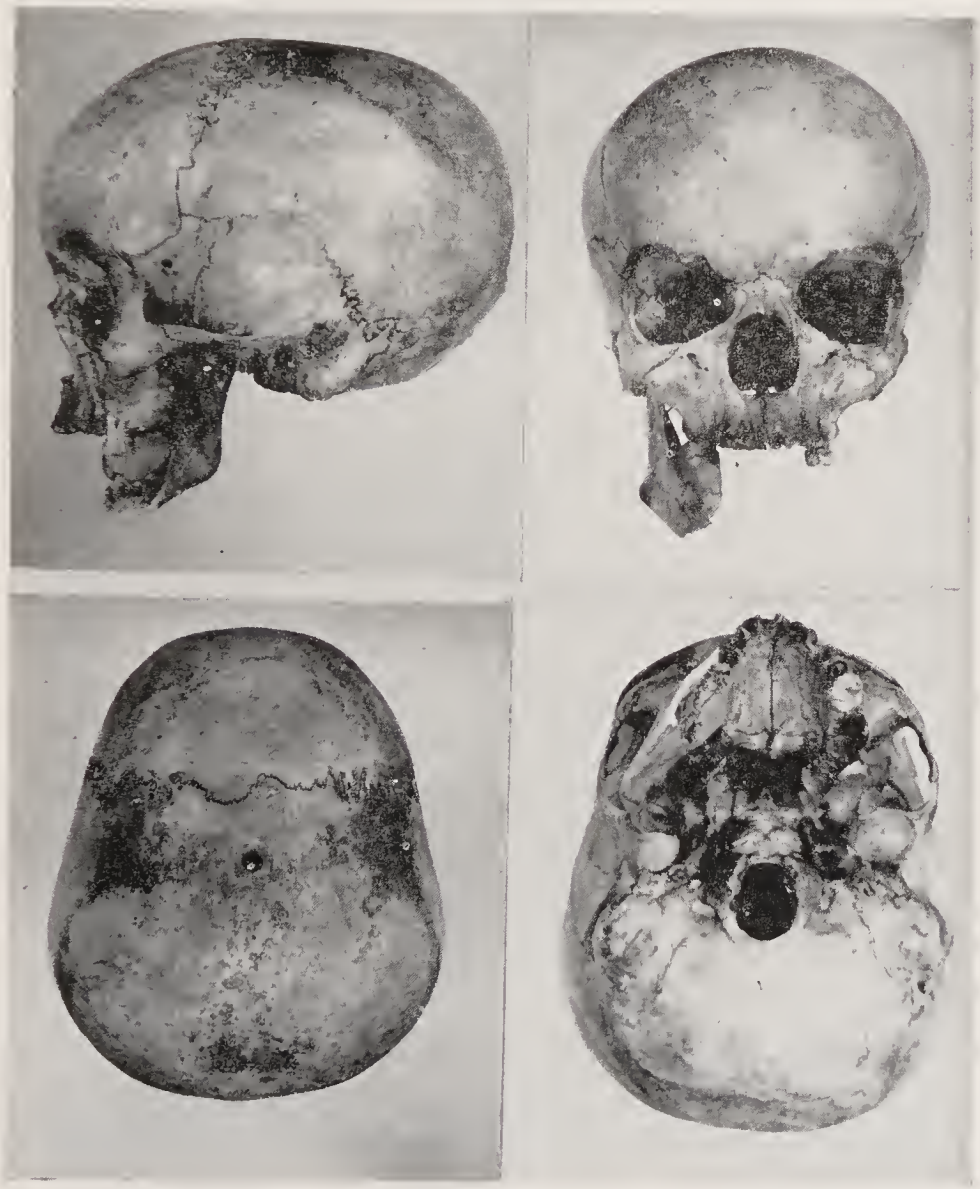

Figure 33. The side, front, top and bottom views of the Cincinnati female dwarf skull. Note in the view of the top that the sagittal suture is obliterated while the coronal is open. The hole is for the mounting apparatus. Courtesy University Museum, Department of Anthropology & Archaeology, University of Kentucky, Lexington.

Figure 34. Comparison of the cranial and soft part morphology of typical achondroplastic dwarfs. Upper: The skull of the Tonkin male. Lower: The head of an American male dwarf made to the same size as the skull. The upper photographs reproduced with permission from the publishers. Photographs of the American Courtesy of C. W. Dupertuis.

SUMMARY

Metrically and morphologically, the two aboriginal dwarf skeletons are clearly and characteristically distinct from the normal Moundville Indian by reason of their short extremities, normal trunks and enlarged heads. Except for minor differences in size, the bones of the male and female are extremely similar. The skulls are very round, springing as they do from a normal strain of people characterized by brachycephaly, often exaggerated by intentional deformation of the head.

Other dwarf skeletons all characterized by the same type of deformity, presented similar morphology—overlarge skulls with small, poorly developed bases, concave facial profiles, short and heavy arm and leg bones, straight and nearly normal trunk segments, sharp lumbar curvatures, and poor extensions of the forearms. Remarkable similarities were observed between the Moundville and Tonkin male dwarfs, both of Mongoloid extraction.

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Table I

COMPARATIVE MORPHOLOGY

DWARF SKULLS

Morphological Observation	Moundville Male	Tonkin Male	Moundville Female	Cincinnati Female
Muscularity	Large	Medium ?	Medium	Medium
Weight	Medium	----------	Medium	Medium
Deformation	Vertical Occipital	None	Probably Occipital	None
Degree of deformation	Pronounced	None	?	Natural Flattening
Skull form	Round	Oval	Round	Ovoid to Sphenoid
FRONTAL REGION				
Browridges	Continuous	Median	Median	Median
Browridge size	Large	Medium ?	Trace	Trace
Frontal height	Very High	High	High	Medium
Frontal slope	Slight	Bulging	Bulging	Bulging
Glabellar eminence	Medium	Small ?	Trace	Small
Metopism	Traces	None ?	(None ?)	Traces
Postorbital constriction	Large	----------	Large	Medium
Bosses	Very Large	Large	Very Large	Large
Median crest	Small	None ?	None	Small
Maximum breadth	Very Large	Large ?	Large	Medium
PARIETAL REGION		----------		
Size	Very Large	Very Large	Large	Medium
Sagittal elevation	Medium	Small	Small	Small
Postcoronal depression	None	----------	Small	Small
Bosses	Large	Very Large	Large	Large

Foramina	Large	----------	?	1 Large
TEMPORAL REGION				
Fullness	Large	Medium ?	Concave	Medium
Mastoid processes	Large	Medium ?	Medium	Medium
Mastoid foramen	?	----------	Very Large	Large
Supramastoid crest	Medium	----------	Medium	Small
Sphenoid depression	?	----------	Medium	Small
Mandibular fossa depth	Large	----------	Small	Medium
Postglenoid process	Large	----------	Small	Small
Tympanic plate	Thick	----------	Medium	Thick
Auditory meatus shape	Ellipse	----------	Round	Oval
Exostoses in meatus	Present	----------	None	None
Petrous depressions	Medium	----------	Large	Medium
OCCIPITAL REGION				
Curve	Small	Pronounced	?	Med. to Pron.
Position	Low	Medium	----------	Low
Form	Broad	Medium	----------	Medium-Broad
External occipital protuberance	Large	Medium	----------	Small
Nuchal attachment	Medium	Medium	----------	Small
Torus	Medium	Medium	----------	Small
Shape	Ridge	Ridge	----------	Ridge
Lambdoidal flattening	Medium	None	----------	None
Serration: Coronal	Submedium	----------	Medium	Pronounced
Sagittal	Submedium	----------	Simple ?	Closed
Lambdoidal	Medium	----------	----------	Closed
Wormian bones	Few	----------	Frontal	Frontal
Basion-porion depth	Negative	Small ?	Negative	Medium
Condyle projection	Very Low	Low	Low	Medium
Styloids	Large	----------	Large	Medium

Table I—(Continued)

Morphological Observation	Moundville Male	Tonkin Male	Moundville Female	Cincinnati Female
Pharyngeal tubercle	Medium	----------	?	Small
Pharyngeal fossa	Submedium	----------	?	Medium
FACE				
Size	Large	Medium	Medium	Small
Orbits shape	Rhomboid	Quadrangular ? Round	Rhomboid	Ovoid
Orbits inclination	Pronounced	Pronounced	Pronounced	Medium
Suborbital fossae	Deep	Deep ?	Medium	None
Infra maxillary notch	Deep	----------	Deep	Small to None
Malar size	Large	----------	Medium	Medium
Malar height	Medium	----------	Medium	Small to Medium
Malar projection: Lateral	Medium	----------	Medium	Small
Anterior	Medium	----------	Medium	Small
Marginal process (malar)	Large	----------	Submedium	Medium
Natsion depression	Medium to Deep	Small ?	Small	Small
Nasal root height	Low	Low	Very Low	Medium
Nasal root breadth	Medium	----------	Medium	Broad
Nasal bridge height	?	----------	(Low ?)	Low
Nasal bridge breadth	?	----------	(Medium ?)	Large
Nasal profile	(Concave ?)	----------	(Concave ?)	Concave
Nasal sills	Dull	----------	Sharp	Sharp

Nasal spine	Medium	Large	Small ?	Small
Subnasal grooves	Slight	Pronounced ?	Fossa	Fossa
Total facial prognathism	Medium to Pron.	Pronounced	Pronounced	Slight
Midfacial prognathism	Pronounced	Pronounced	Absent	Absent
Alveolar prognathism.	Pronounced	Pronounced	Pronounced	Medium to Pron.
Palate shape	Hyperbolic?	Parabolic	Hyperbolic	Hyperbolic
Palate height	Medium	.....	Very High	Medium
MANDIBLE				
Size	Large	.....	Medium	Small ?
Chin form	Small	.....	Negative	.....
Alveolar prognathism.	Medium	Pronounced	Pronounced	.....
Genial tubercles	Small	.....	Medium	.....
Torus	None	.....	None	.....
Gonial angle eversion	Pronounced	.....	Small	Small
Ante-mortem tooth loss.	10 - 12	.....	6	None
Tooth wear	Pronounced	.....	Slight	Very Slight
Caries	6	.....	1 or 2	None
Abscesses due to caries	6	.....	?	.....
Shovel incisors	?	Pronounced	Medium	?
Bite	Edge ?	.....	Small over	?

COMPARATIVE TABLE II

MOUNDVILLE SERIES

MEASUREMENT (in millimeters)	MALE DWARF	DEFORMED MALES† No.	Range	Mean	FEMALE DWARF	DEFORMED FEMALES† No.	Range	Mean
Glabello—occipital length	[177]	21	155-181	[164.3]	-----	16	143-172	[159.0]
Maximum breadth	[183]	26	141-163	[152.9]	[158]	23	132-157	[147.6]
Basion—bregma height	[145]	6	139-154	[142.8]	[(130)]**	6	130-149	[138.5]
Auricular height	[141]	9	121-138	[127.7]	-----	6	119-129	[124.3]
Minimum frontal breadth	[105]	20	85-103	[95.8]	94	16	89-103	[93.8]
Frontal chord	130	20	103-117	110.8	118	26	98-115	105.7
Basion—nasion length	92	4	95-107	100.5	(84)	2	100-102	101.0
Basion—prosthion length	96	3	96-100	98.3	-----	3	93-96	94.6
Horizontal circumference	[576]	9	478-521	[496.8]	-----	6	478-502	[488.3]
Nasion—opisthion arc	[414]	10	327-369	[349.6]	-----	6	321-354	[343.5]
Transverse arc	[395]	11	310-350	[325.6]	(364)	9	291-342	[317.3]
	calculated		seed method					
Capacity in cc	[2011.0]	2	1420-1640	[1530.0]	-----	---	----------	-----
Frontal angle	59°	8	52-62	57.9°	-----	4	57-65	61.0°
Total facial angle	87°	4	83-92	87.5°	-----	2	82-89	85.5°
Midfacial angle	95°	6	85-91	87.8°	-----	2	93	93.0°

**Brackets [] indicate figures affected by the cranial deformation.

Parentheses () indicates approximate values.

†Unpublished data prepared by the writer.

Alveolar angle	60°	4	60-76	70.5°	------	1	--------------	71.0°
Bizygomatic breadth	138	5	131-148	142.0	(125)	5	131-136	133.2
Midfacial breadth	96	2	97-102	99.5	(94)	7	91-103	97.3
Total facial height	133^{9}*	7	113-125	120.0	116^{3}	2	104-116	110.0
Upper facial height	68	10	65-76	71.6	69	2	68-70	69.0
Nasal height	49	12	45-56	51.0	48	4	46-55	49.5
Nasal breadth	(25)	10	21-27	25.1	(25)	5	25-28	26.6
Orbital height	33.5 Rt	11	30-38	34.6	31 33 Rt	5	31-35	33.4
Orbital breadth: maxillo-frontale	46 Rt	9	40-45	42.7	38 39 Rt	6	39-43	41.2
Orbital breadth: dacryon	44 Rt	7	38-43	40.0	------	6	37-40	38.7
Anterior interorbital breadth (MF)	18	7	17-22	19.6	(20)	3	16-21	18.3
Biorbital breadth	(106)	7	96-100	99.0	92	5	92-100	97.0
Internal orbital breadth	107	10	94-104	98.6	------	----	--------------	------
Maxillo-alveolar length	(50)	8	49-58	55.0	(50)	3	54-56	54.6
Maxillo-alveolar breadth	(61)	9	62-71	66.3	(67)	6	64-70	67.2
MANDIBLE								
Condylo-symphyseal length	(103)	9	100-110	104.9	(98)	4	95-105	99.2
Bicondylar breadth	(122)	6	124-127	125.3	(124)	4	117-127	122.7
Bigonial breadth	110	9	88-114	104.9	94	5	94-106	101.2
Height of symphysis	37	8	33-38	33.7	(35)	4	32-34	32.5
Mandibular height	58	11	50-73	58.4	49	5	36-58	49.2
Min. Br. ascending ramus	28	13	31-43	34.7	29	5	34-38	35.6
Mandibular angle	(119°)	12	111-131	118.2°	124°	5	115-133	122.6°
INDICES								
Cranial	[103.4]	21	77.9-104.5	[93.8]	------	17	82-104.7	[92.6]
Length height	[81.9]	5	78.4-95.1	[87.2]	------	6	79.3-94.4	[86.5]
Breadth height	[79.2]	6	81.5-100.7	[92.0]	[(82.3)]	5	86.7-100	[96.1]
Length-auricular height	[79.7]	7	73.2-90.0	[80.0]	------	6	69.2-80.3	[75.3]

*Superscript indicates amount added for tooth wear.

COMPARATIVE TABLE II—(Continued)

MEASUREMENT (in millimeters)	MALE DWARF	DEFORMED MALES† No.	Range	Mean	FEMALE DWARF	DEFORMED FEMALES† No.	Range	Mean
Mean height	[80.6]	6	86.8-97.8	[89.8]	------	6	82.8-95.2	[90.6]
Cranial module	[168.3]	5	150-156.3	[152.8]	------	5	142.3-154.2	[148.4]
Frontal-parietal	[57.4]	14	55.6-69.2	[62.4]	59.5	13	58.3-66.9	[62.4]
Total facial	96.4	4	76.5-91.1	83.2	(92.8)	2	79.6-83.3	82.0
Upper facial	49.3	4	45.3-55.6	50.5	(55.2)	1	------	50.4
Midfacial	70.8	6	63.4-73.5	69.0	(73.4)	1	------	72.3
Cranio-facial	[(75.4)]	4	86.5-94.0	[90.7]	[(79.1)]	3	88.0-95.0	[92.6]
Zygo-gonial	(79.7)	6	62.2-76.4	70.5	(75.2)	2	75.8-77.6	77.0
Fronto-gonial	104.8	4	95.6-127.0	109.2	(100.0)	1	------	107.4
Zygo-frontal	(76.1)	3	67.6-68.6	68.3	(75.2)	1	------	67.6
Nasal	(51.0)	7	46.-57.8	50.6	(52.1)	4	53.3-58.7	56.0
Orbital maxillo-frontale	72.8 Rt	9	75.-88.4	81.6	(81.6)	4	77.5-81.4	79.5
Orbital dacryon	76.1	7	79.1-94.7	87.6	------	5	83.8-89.7	86.6
Palatal	(122.0)	3	123.6-134	127.7	(134.0)	2	118.5-127.8	123.0
Mandibular L-Br.	(84.4)	8	75.8-87.9	79.9	(79.0)	3	77.9-82.9	81.3
Mandibular L-Ht.	(56.3)	8	42.7-70.2	57.0	(50.0)	5**	------	(49.4)**

**Calculated from means of measurements.

COMPARATIVE TABLE III
POST-CRANIAL SKELETON

HUMERUS

Males—Right

	Moundville Dwarf	No.	Moundville* Range	Mean
Max. Length	185 mm	3	300-312	307.3 mm
Mid. Circum.	62	1	-	66.0
Bitrochlear	-	3	298-309	305.3
Max. Diam. Head.	45	3	44-47	(45.7)†
Maximum Middle	22	5	21-24	22.8
Minimum Middle	16	5	16-19	17.2
Mid. Index	72.7	5	70-82	75.6
Index Robustness	33.5	1	-	21.2
Hum.-Fem. Index	69.8	2	71-72	71.5

CLAVICLE

Males—Right

	Moundville Dwarf	No.	Moundville* Range	Mean
Max. Length	130 mm	5	135-160	(147.9) mm
Mid. Circum.	36	2	35-38	36.5
Index Robust.	27.7	2	22-24	23.0
Cl.-Hum. Index	70.3	2	50-51	50.5

RADIUS

Males—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. length	166 mm	2	225-237	231.5 mm
Mid. Circum.	39	2	43-46	44.5
Index Robustness	23.5	1	-	(19.4)
Hum.-Rad. Index	89.7	1	-	79.0

ULNA

Males—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	(174) mm	2	260-273	266.5 mm
Mid. Circum.	45	3	46-50	48.3
Index Robustness	(25.9)	1	-	16.8

†Parentheses () indicate approximate measurements.

*Snow, Charles E. "Indian Skeletons from the Museum Burials at Moundville" Geological Survey of Alabama, Museum Paper 15, 1941, pp. 34-37.

COMPARATIVE TABLE III—(Continued)

POST-CRANIAL SKELETON

FEMUR

Males—**Right**

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	265 mm	6	416-461	442.2 mm
Mid. Circum.	74	3	86-98	92.0
Bicondylar L.	263	5	411-457	441.5
Max. Diam. Head	------	8	42-50	(46.0)
Sub. A. P. Diam.	22	9	21-29	26.0
Sub. Lat. Diam.	38	9	29-37	(32.8)
Mid. A. P. Diam.	20	0	25-36	31.4
Mid. Lat. Diam.	26	9	25-29	27.2
Platy. Index	57.9	9	68-94	(79.8)
Mid. Index	130.0	8	78-104	90.2
Index Robustness	27.9	2	20-22	21.0

Males—**Left**

Moundville Dwarf	No.	Moundville Range	Mean
259 mm	6	423-469	449.8 mm
77	3	84-92	89.3
255	5	420-466	(448.5)
45	5	42-49	(46.4)
23	9	21-28	26.0
30	9	29-38	33.1
20	9	25-36	30.8
27	8	25-30	27.9
76.7	9	66-90	79.2
135.0	8	83-108	90.2
29.7	3	19-21	20.0

TIBIA

Males—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	(216) mm	4	355-383	(370.0) mm
Mid. Circum.	(78)	2	86-95	90.5
Physio. Length	-----	4	340-368	(356.0)
Nutrient A.P.	32	7	31-45	38.3
Nutrient Lat.	29	7	21-28	24.9
Middle A.P.	27	8	28-37	33.0
Middle Lat.	(24)	8	18-25	21.9
Platy. Index	90.6	7	56-74	64.4
Mid. Index	(88.9)	8	54-76	66.8
Index Robustness	(36.1)	2	23-26	(24.5)
Tibio-Fem. Ind.	(81.5)	3	85-86	(85.3)

FIBULA

Males—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	-----	3	355-370	(364.2) mm
Mid. Circum.	44 mm	2	39-50	44.5

COMPARATIVE TABLE IV

POST-CRANIAL SKELETON

HUMERUS

Females—Right

	Moundville Dwarf	No.	Moundville* Range	Mean
Max. Length to head	168 mm	4	300-313	306.8 mm
Mid. Circum.	58		-	- - mm
Bitrochlear	167	5	295-312	(302.7)
Max. Diam. Head	39	4	40-42	40.5
Maximum Middle	22	5	18-23	20.8
Minimum Middle	17	5	14-8	15.6
Mid. Index	77.3	5	65-80	75.1
Index Robustness	34.5	--	-	-----
Hum.-Feb. Index	71.2	5	72-75	73.4
Condylo-Diaph. Angle	86°	--	-	-----

Females—Left

Moundville Dwarf	No.	Moundville Range	Mean
166 mm	4	295-312	302.5 mm
59	-	-	-----
166	5	288-309	297.3
39	4	40	40.0
22	5	19-23	20.6
15	5	13-17	15.4
68.2	5	68-80	74.9
35.5	--	-	-----
70.0	4	71-74	72.2
89.5°	--	-	-----

CLAVICLE

Females—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	(116) mm	4	129-140	(135.0) mm
Mid. Circum.	30	--	-	-----
Index Robustness	(25.9)	--	-	-----
Cl.-Hum. Index	(66.7)	4	43-45	(44.2)

Females—Left

Moundville Dwarf	No.	Moundville Range	Mean
(117) mm	4	132-140	(137.0) mm
30	--	-	-----
(25.6)	--	-	-----
(68.8)	4	45-46	(45.5)

RADIUS

Females—Right

	Moundville Dwarf	No.	Moundville* Range	Mean
Max. Length	134 mm	4	232-245	(237.0) mm
Mid. Circum.	35	--	-	-----
Index Robustness	26.1	--	-	-----
Hum.-Rad. Index	80.0	5	75.79	(77.6)

Females—Left

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	140 mm	4	230-242	235.8 mm
Mid. Circum.	36	--	-	-----
Index Robustness	25.7	--	-	-----
Hum.-Rad. Index	84.3	4	76-79	77.8

ULNA

Females—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	155 mm	4	247-259	(251.0) mm
Mid. Circum.	38	--	-	-----
Index Robustness	24.5	4	-	-----

Females—Left

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	153 mm	4	248-256	(251.8) mm
Mid. Circum.	37	--	-	-----
Index Robustness	24.2	--	-	-----

*Snow, Charles E., "Indian Skeletons from the Museum Burials at Moundville", Geological Survey of Alabama, Museum Paper 15, 1941, pp. 34-37.

COMPARATIVE TABLE IV—(Continued)

POST-CRANIAL SKELETON

FEMUR

Females—**Right**

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	240 mm	5	411-442	423.5 mm
Mid. Circum.	70	--	-	-----
Bicondylar L.	236	5	407-435	418.7
Max. Diam Head	40	6	39-44	(41.5)
Sub. A. P. Diam.	24	8	20-25	22.2
Sub. Lat. Diam.	23	8	29-33	30.8
Mid. A. P. Diam.	22	7	24-30	27.0
Mid. Lat. Diam.	22	7	23-28	24.9
Platy. Index	104.4	8	67-81	72.8
Mid. Index.	100.0	7	80-100	92.0
Index Robustness	29.2	--	-	----

Females—**Left**

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	239 mm	5	415-440	424.3 mm
Mid. Circum.	70	--	-	-----
Bicondylar L.	-----	5	408-435	419.7)
Max. Diam Head	40	6	39-45	(41.7)
Sub. A. P. Diam.	23	8	21-25	23.2
Sub. Lat. Diam.	24	8	30-32	30.8
Mid. A. P. Diam.	22	7	25-29	27.1
Mid. Lat. Diam.	23	7	23-27	25.1
Platy. Index	95.8	8	66-80	74.0
Mid. Index.	104.6	7	83-100	92.6
Index Robustness	29.3	--	-	----

TIBIA

Females—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Max. Length	(197) mm	3	334-373	352.5
Mid. Circum.	65	--	-	-----
Physio. Length	184	5	322-362	336.9
Nutrient For A. P.	25	5	30-37	34.2
Nutrient For Lat.	20	4	18-25	22.0
Middle A. P.	25	6	28-34	30.3
Middle Lat.	18	6	18-23	19.7
Platy. Index	80.0	4	60-69	65.0
Mid. Index	72.0	6	53-77	64.8
Index Robustness	(330)	--	-	-----
Tibio.-Fem. Index	(82.1)	5	80-84	(82.2)

COMPARATIVE TABLE IV—(Continued)

POST-CRANIAL SKELETON

LUMBAR VERTEBRAE

Females

Anterior

	Moundville Dwarf	No.	Moundville Range	Mean
L. I	(23)	5	23-28	(25.2) mm
L. II	(23)	5	24-28	(26.0)
L. III	(24)	5	23-29	(26.4)
L. IV	(25)	5	24-29	(26.8)
L. V	27	6	25-29	(27.6)

Posterior

	Moundville Dwarf	No.	Moundville Range	Mean
L. I	27 mm	5	24-29	(27.0) mm
L. II	27	5	26-39	27.4
L. III	28	5	25-30	(27.6)
L. IV	26	5	24-30	(26.8)
L. V	23	6	21-28	23.6
Index	(107.4)	4	96-102	(100.0)

SACRUM

Females

	Moundville Dwarf	No.	Moundville Range	Mean
Sacral Height	84 mm	5	98-110	(102.6) mm
Sacral Breadth	84	6	106-125	(116.5)
Sacral Index	100.0	5	106-126	(113.7)

PELVIS AS A WHOLE

Females

	Moundville Dwarf	No.	Moundville Range	Mean
Total Breadth	231 mm	3	255-266	(262.0) mm
Maximum Breadth	119	4	125-136	129.8
A. P. Diameter	62	2	105-109	107.0
Bi-isch. Breadth	152	--	-	-----
Brim Index	52.1	2	77-83	80.0
Total Pelvis Index	(63.8)	2	71-80	(75.5)

PELVIS HALVES

Females—Right

	Moundville Dwarf	No.	Moundville Range	Mean
Pelvis Height	(143) mm	4	182-204	190.5 mm
Pelvis Breadth	121	4	134-154	(142.5)
Pelvis Index	(118.2)	4	127-141	(134.5)

Females—Left

	Moundville Dwarf	No.	Moundville Range	Mean
	152 mm	3	185-205	194.8 mm
	127	4	135-155	(147.0)
	119.7	3	125-135	(129.3)

COMPARATIVE TABLE V

MEASUREMENTS AND INDICES

DWARF CRANIA

Measurements in Millimeters	Moundville Male	Tonkin Male	Moundville Female	Cincinnati Female	Lyon Museum Female
Glabello-occipital Maximum Length	177 mm	194 mm	-----	175 mm	184 mm
Glabello-inion Length	172	175	-----	160	-----
Glabello-lambdoidal Length	172	191	-----	172	-----
Maximum Breadth	183	154	158	139	160
Minimum Frontal Breadth	105	107	94	90	-----
Maximum Frontal Breadth	(147)	137	141	115	-----
Bi-auricular Breadth	130	115	113	98	-----
Bi-asteric Breadth	119	108	(129)	109	-----
Bi-mastoidal Breadth	100	86	96.7	89	-----
Basion-bregma Height	145	143	(130)	126	-----
Auricular Height	141 (Vertex)	147 (Bregma)	-----	-----	-----
Basion-nasion Length	92	92	(84)	85	-----
Total Facial Height	133[6]*	122	116[3]	-----	-----
Upper Facial Height	68	75	69	61	-----
Bizygomatic Diameter	(138)	126	(125)	109	-----
Greatest Breadth	-----	106	-----	-----	-----
Mid-facial Breadth	96	83 ?	(94)	83	-----
Bi-orbital Breadth	(106)	99	92	90	-----
Inter-orbital (M.F.Br.)	18	25	(20)	21	-----
Orbital Breadth (M.F.)	46 (Right)	41	(38)	(39) Rt.	L.38-38R.
Orbital Height	33.5 (Right)	38	(31)	(33) Rt.	L.30-31R.

Nasal Breadth	(25)	25	(25)	24	----
Nasal Height	49	59	48	43	----
Minimum Breadth Nasalia	12	----	8	12	----
Maximum Breadth Nasalia	(19)	----	13	19	----
Mean Diameter Foramen Magnum	25.5	29.5	----	22.5	----
Maxillo-alveolar Length	(50)	46	(50)	47	----
Maxillo-alveolar Breadth	(61)	62	(67)	(57)	----
Total Facial Angle	87°	88.3°	----	----	----
Upper Facial Angle	95°	104° (Nasal?)	----	----	----
Alveolar Angle	60°	66.3°	----	----	----
Horizontal Circumference	576	563	----	505	515
Transverse Arc	395	373	(364)	312	----
Nasion-opisthion Arc	414	428	----	386	----
Total Frontal Arc	150	160	140	125	----
Median Parietal Arc	153	153	----	161	----
Median Occipital Arc	110	115	----	101	----
Frontal Chord	129	129	118	107	----
Sagittal Chord	126	135	----	132	----
Lambdoidal-opisthion Chord	86.0	99.3	----	89	----
Lambdoidal-inion Chord	47.0	60	----	41	----
Inion-opisthion Chord	58	56	----	56	----
Capacity	2011.0 cc**	2010.0 cc.	----	1370 cc.	----
MANDIBLE					
Condylo-symphyseal Length	(103)	----	(98)	----	----
Bicondylar Breadth	(122)	72	(124)	----	----
Bigonial Breadth	110	87	94	----	----
Mandibular height	----	----	49	----	----
Height of Symphysis	37	30	(35)	----	----

*Superscript indicates amount added for tooth wear.

**Calculated capacity.

COMPARATIVE TABLE V—(Continued)

Measurements in Millimeters	Male Moundville	Tonkin Male	Moundville Female	Cincinnati Female	Lyon Museum Female
Minimum Breadth Ascending Ramus	28	34	29	26 Rt.	-----
Mandibular Angle	(119°)	105°	124°	-----	-----
INDICES					
Cranial	103.4	79.4	-----	79.5	87.0
Length-height	81.9	73.7	-----	72.0	-----
Breadth-height	79.2	92.8	(82.3)	90.6	-----
Length-auricular height	79.7	75.8	-----	-----	-----
Fronto-parietal	57.4	69.5	59.5	64.8	-----
Total Facial	(96.4)	96.8	(92.8)	-----	-----
Upper Facial	49.3	59.5	(55.2)	56.0	-----
Mid. Facial	70.8	90.4	(73.4)	73.5	-----
Cranio-facial	(75.4)	81.8	(79.1)	78.4	-----
Zygo-gonial	(79.7)	69.0	(75.2)	-----	-----
Fronto-gonial	104.8	81.3	(100.0)	-----	-----
Zygo-frontal	(76.1)	84.9	(75.2)	82.5	-----
Biorbital-frontal	99.1	-----	(102.1)	100.0	-----
Nasal	(51.0)	42.4	(52.1)	55.8	-----
Orbital (M.F.)	72.8 (Right)	92.7	(81.6)	78.9	-----
Palatal	(122.0)	95.2	(134.0)	(121.2)	-----
Mandibular	(84.4)	-----	(79.0)	-----	-----

COMPARATIVE TABLE VI

MEASUREMENTS & INDICES

DWARF POST CRANIAL SKELETONS

HUMERUS

Measurements & Indices	Moundville Male		Tonkin Male†		Moundville Female		Cincinnati Female		Lyon Museum Female‡	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum Length to Head	185 mm	-----	149 mm	148 mm	168 mm	166 mm	142 mm	142 mm	150*mm	150*mm
Max. Length to Tubercle	(188)	-----	-----	-----	173	169	145	145	-----	-----
Maximum Diameter Head	45	-----	24	25	39	39	38	38	-----	-----
Maximum Middle Diameter	22	-----	19	17	22	22	20	19	-----	-----
Minimum Middle Diameter	16	-----	14	15	17	15	17	16	-----	-----
Middle Circumference	62	-----	65	70	58	59	58	58	-----	-----
Middle Index	72.7	-----	73.7	88.2	77.3	68.2	85.0	84.2	-----	-----
Index Robustness	33.5	-----	43.6	47.3	34.5	35.5	40.8	40.8	-----	-----
Hum.-Fem. Index	69.8	-----	-----	-----	71.2	70.0	68.6	69.5	75.0	75.0
Total Upper Arm Length (Articulated humerus & ulna in complete extension)	(321) mm	-----	377 mm	369 mm	284mm	-----	-----			

RADIUS

Maximum Length	166 mm	-----	123 mm	121 mm	134mm	140 mm	-----	117	112*mm	112*mm
Middle Circumference	39	41	33	32	35	36	-----	28	-----	-----
Index Robustness	23.5	-----	26.8	26.4	26.1	25.7	-----	23.9	-----	-----
Hum.-Rad. Index	89.7	-----	82.6	81.8	80.0	84.3	-----	82.4	74.7	74.7

COMPARATIVE TABLE VI—(Continued)

MEASUREMENTS & INDICES

DWARF POST CRANIAL SKELETONS

CLAVICLE

Measurements & Indices	Moundville Male		Tonkin Male†		Moundville Female		Cincinnati Female		Lyon Museum Female‡	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum Length	130 mm	------	------	------	(116)mm	(117)mm	108	110	------	------
Middle Circumference	36	31 mm	------	------	30	30	28	25	------	------
Index Robustness	27.7	------	------	------	(25.9)	(25.6)	25.9	22.8	------	------
Claviculo-Humeral Index	70.3	------	------	------	(69.0)	(70.0)	76.0	77.4	------	------

ULNA

Maximum Length	(171) mm	------	134 mm	135 mm	155 mm	153 mm	------	148	136*mm	136*mm
Middle Circumference	45	(42)	------	------	38	37	------	------	------	------
Index Robustness	(26.3)	------	------	------	24.5	24.2	------	23.6	------	------

FEMUR

Max. Length to Head	265 mm	258 mm	207 mm	210 mm	240mm	239 mm	207 mm	204 mm	200*mm	200*mm
Max. Length to Troch.	263	261	207	212	236	237	202	202	.....	.....
Maximum Diameter Head	.....	45	37	35.8	40	40	36	36	.....	.....
Subtrochanter A. P.	22	23	22.3	21.1	24	23	21	22	.....	.....
Subtrochanter Lateral	38	30	32.0	31.2	23	24	25	24	.....	.....
Middle A. P.	20	20	18.1	19.2	22	22	17	16	.....	.....
Middle Lateral	26	27	18.0	18.2	22	23	20	21	.....	.....
Platy Index	57.9	76.7	69.7	67.6	104.3	95.8	84.0	91.7	.....	.....
Middle Index	130.0	135.0	99.4	94.8	100.0	104.5	117.7	131.2	.....	.....

TIBIA

Maximum Length	(216) mm	.....	170 mm	168 mm	(197) mm	.....	178	182	174*mm	174*mm
Nutrient Foramen A. P.	32	.....	20.5	22.4	25	.....	21	20	.....	.....
Nutrient Foramen Lateral	29	.....	23.0	23.3	24	.....	21	19	.....	.....
Circum. at Nutrient Foramen	91	.....	53.0	53.0	76	.....	.....	.....	.....	.....
Platy. Index	90.6	.....	112.2	104.0	96.0	.....	100.0	95.0	.....	.....
Index of Robustness at Nutr. For.	(42.1)	.....	31.1	31.1	(38.6)	.....	.....	.....	.....	.....
Tibio-Fem. Index	(81.5)	.....	82.1	80.0	(83.5)	.....	86.1	89.2	87.0	87.0

†Do-Xuan-Hop: "Etude de squelette d'un nain tonkinois"; par De-Xuan-Hop et Nguyen. (Hanoi. *Ecole superieure de medecine de l'Indochine. Institut anatomique.* Section anthropologique. Travaux, 1939, t.V, pp. 177-196.

‡Lannois, M. "Quelques cas de nanisme." (Société d'anthropologie de *Lyon, Bulletin*, Lyon, 1902. y.XXI, fasc. 2, pp. 191-210.)

*Reference gives mean value only.

COMPARATIVE TABLE VI—(Continued)

MEASUREMENTS & INDICES

DWARF POST CRANIAL SKELETONS

FIBULA

Measurements & Indices	Moundville Male		Tonkin Male†		Moundville Female		Cincinnati Female		Lyon Museum Female‡	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Maximum Length	-----	-----	180′mm	180′mm	-----	-----	197 mm′	200 mm′	185*mm′	185*mm′
Tibio-fibular Index	-----	-----	106.0	107.0	-----	-----	110.7	110.0	106.3	106.3

LUMBAR VERTEBRAE

Measurements & Indices	Tonkin Male	Moundville Female
Total Lumbar Column	99.6 mm	134.0 mm††
		126.5‡‡

†Ibid.

‡Ibid.

c 5th Lumbar fused onto sacrum.

*Ibid.

′Some anatomists recognize the excessive length of the fibula over the tibia as characteristic of achondroplastic dwarfs. In normal individuals the Tibia is longer than its slender mate, the fibula.

††Anterior measurements (approximate) of erect lumbar column.

‡‡Average of the sums of the posterior and anterior lumbar vertebrae.

COMPARATIVE TABLE VI—(Continued)

MEASUREMENTS & INDICES

DWARF POST CRANIAL SKELETONS

SACRUM

Measurements & Indices	Moundville Male	Tonkin Male	Moundville Female	Cincinnati Female	Lyon Museum Female‡
		(6 segments)			
Height	-----	117 mm	84 mm	120 mm	-----
Maximum Breadth	-----	76	84	82	-----
Upper Breadth	-----	70	-----	-----	-----
Lower Breadth	-----	46	-----	-----	-----
Sacral Index	-----	65.0	100.0	68.3	-----

PELVIS AS A WHOLE

Total Breadth (Bi-Iliac)	-----	216 mm	231 mm	(202) mm	-----
Anterior Breadth	-----	206	221	-----	-----
			192	-----	-----
Posterior Breadth	-----	45	(71-75)	-----	-----
Maximum Brim. Breadth	-----	101	119.0	(103)	110 mm
				∫ 74 upper (6th Lumbar)	
Anterior-Posterior Diam.	-----	46	62.0	⌇ 53 lower'	57.5
Brim. Index	-----	45.5	52.1	51.5	52.3

COMPARATIVE TABLE VI—(Continued)

MEASUREMENTS & INDICES

DWARF POST CRANIAL SKELETONS

PELVIS HALVES

Measurements & Indices	Moundville Male		Tonkin Male		Moundville Female		Cincinnati Female		Lyon Museum Female‡	
	Right	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**	**Right**	**Left**
Innominate Height	-----	170 mm	137 mm	137 mm	(143)mm	152	142 mm	141	-----	-----
Innominate Breadth	133 mm	-----	112	115	121	127	116	116	-----	-----
Brim Height	-----	-----	84	83	74	74	-----	-----	-----	-----
Index	-----	-----	112.3	119.1	(118.2)	(119.7)	112.2	112.1	-----	-----

†Ibid.

‡Ibid.

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